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A DUAL PERSPECTIVE APPROACH TO TIME
IN DESCARTES

by

Kathleen Kerrott Madden

A Dissertation Submitted to the Faculty of the Graduate School
of Loyola University of Chicago in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy

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1990

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Ad maiorem Dei gloriam.

VITA

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INTRODUCTION

The central theme of this study is the subject of time in Descartes. Two considerations provoke this undertaking. Despite the wealth of literature on Descartes, there has been no one single volume work that has offered an incisive and comprehensive examination of Descartes' theory of time. What has been attempted in the way of studies, for the most part, has treated time in a modified way as a tangential issue in Descartes' philosophy; or the studies have assumed a narrower vision and focused on a single aspect of the Cartesian theory of time. Secondly, and more importantly, is the consideration that time presents itself as a convoluted concept in Descartes' philosophical works. Descartes never treated time in any systematic fashion as a special subject of examination. What he says about time is dispersed throughout the corpus of his works. Hence, we find misinterpretations and objections by critics that may arise from a failure to view time within its immediate context, and, more importantly, within the broader context of Descartes' overall philosophical concerns. Because of these considerations, our intent is to provide an in-depth study that will examine the myriad aspects of Descartes' theory of time and will give a clear understanding of the role time plays in the Cartesian philosophy.

Four goals will distinguish our study from others. First of all, this study will view time as an integral and important component in Descartes' philosophy, a system of interrelated issues understood in terms of one another. The point of departure and yet the ultimate point of reference for our analysis is Descartes' fundamental and primary goal to establish a universal science. Descartes was committed to the belief that this universal science, which is most accurately described as a mathematical kind of physics, could provide the solutions to all the questions of nature.

Without equivocation, Descartes made known that his metaphysics was meant solely to serve as a foundation for his physics. Distinguished by its radical dualism, Descartes' metaphysics polarizes the finite order into two separate and independent kinds of substances. There is the material substance having the sole attribute of extension and there is the thinking substance having the sole attribute of thought. Common to both kinds of substances are existence, unity, substance, and duration, yet these substances remain essentially heterogeneous. Although time is a feature of both kinds of substances insofar as these substances share a common duration, their radical disparity cannot be overcome. Hence, an account of a Cartesian theory of time has to explain how time as such is to be a property of each kind of substance.

Time cannot be interpreted as a univocal predicate applicable to both kinds of substances. Descartes' metaphysical dualism makes it necessary to examine time as an analogical concept. Such an approach provides us with a perspective of time that is in accordance with the exigencies of Descartes' metaphysics and with his philosophy taken as a systematic whole. It is our intent to validate our approach by providing a developmental argument. It starts out with the genesis of Descartes' project, and proceeds on to various aspects of time and then relates time to his metaphysical dualism.

The second goal of this study is to address ourselves to the questions raised about the apparent paradoxical nature of Descartes' theory of time. We will consider the standard thesis that the doctrine of continuous creation entails the discontinuity of time as well as the indivisibility of the moment of time. As a result of our analysis, we will be able to resolve these questions so as to leave little doubt regarding the coherency of Descartes' theory of time.

The third goal of the study will be to pursue the mathematical dimensions of time. This is prompted by Descartes' belief that the questions which arise in any science are essentially mathematical questions since their common consideration is the various relationships or proportions between objects. Ultimately, these questions give

rise to problems about order and measure, the concerns of mathematics. Appropriately, we will consider time from a mathematical dimension because time, too, is directly related to the questions of order and measure.

Descartes presents us with a description of time that has mathematical implications. For Descartes time is the "number of movement" and a "measure of duration," and in accordance with Descartes' view that number expresses both order and measure, time as a number can validly be applied to duration. The justification for this is the fact that all substances share a common successive kind of duration, the parts of which are ordered one to another as 'before' and 'after'. As such, each part as a unit falls under the category of discrete numerable quantity. The duration of substances is also continuous, and for that reason can be conceived as measurable quantity analogous to extension. Hence, time as a number can express both the order and measure that characterizes the duration of substances. This study will spell out the dynamics of time when it functions as a number. Our analysis will provide analogies using concepts and elements found in the sciences of arithmetic and geometry. When appropriate, we will use graphic mathematical illustrations as Descartes himself does in the Rules when he wishes to make clear his meaning.

Finally, we will offer a comparative analysis between Descartes' theory of time and Aristotle's theory of time and

also St. Augustine's theory of time. Descartes' descriptions of time as a "number" and "measure" are clearly similar to elements found in Aristotle's treatment of time. Descartes' definition of time as a "mode of thought" introduces a psychological aspect of time that is reminiscent of St. Augustine's theory of time. For these reasons, there is merit in considering both Aristotle's and Augustine's theories of time to trace the roots of Descartes' theory of time. The knowledge of these theories will contribute to our understanding of Descartes' theory. In addition, the comparative analysis will illumine some of the points made in previous chapters.

These four goals will be developed in the following manner: Chapter I will establish that our dual perspective approach is warranted for an accurate understanding of the Cartesian theory of time. The justification for this is grounded in the inextricable, but definitive relationship between three constitutive elements in the Cartesian philosophy, namely, his scientific concerns, his metaphysical dualism, and time. The first and ultimate point of reference for the latter two is Descartes' conviction that his mission in life was to found a mathematical kind of physics characterized by its self-evidency and certitude. With this committed vision Descartes formulated a metaphysics as a foundation for his physics. Epistemological considerations prompted Descartes to propose that the created order

was comprised of two heterogeneous kinds of substances: the material substance, defined solely in terms of extension and the thinking substance, defined solely in terms of thought.

Under the rubric of science, such simple dualism translates into a relationship between the inanimate, material substance as the object known, and the dynamic, thinking substance as the knowing subject. Since Cartesian matter is essentially extension, the universe is geometrical. Further, nature is fundamentally knowable because it operates in accordance with the principles and laws of mathematics. Since the thinking substance is essentially endowed with a faculty for knowing truth, the mind need only act in accordance with a method of prescribed rules to accurately know nature. Given the essential constitution of both the known and the knower, a mathematical kind of universal physics is theoretically possible.

Bound up with Descartes' scientific concerns and his metaphysical dualism is the subject of our study, time. Time, for Descartes, has objective reality. It is a property of all existing things insofar as they have a successive duration. However, the temporality of the two kinds of substances cannot be, and is not, manifested in the same way. The material substance as an extended body is a geometrical inanimate entity. The thinking substance as a soul is a dynamic subject of cognitive activities.

Both kinds of substances share a common duration. In light of Descartes' primary scientific concerns, the mutual co-existence of two radically distinct kinds of substances means that the thinking substance can relate to material substances as knower to the known. Hence, the temporality of the thinking substance is significant in terms of the latter's distinction as an agent of knowing, and the temporality of the material substance is significant solely in terms of its distinction as an object that is known. This dual perspective must condition our understanding of time and the role it plays in Descartes' philosophy.

Descartes describes time as a "measure of duration" and the "number of movement," stipulating that the latter description is applicable to both kinds of substances insofar as they are characterized by a successive duration. As we proceed in the study, the manner in which these descriptions of time are uniquely applied to the material substance and its local motion, and to the thinking substance and its cognitive activities will become evident.

Time is a "number" and a "measure". If something is numbered and measured there must be a soul to do the numbering and measuring. Thus, we find Descartes introducing a psychological aspect of time by calling it a "mode of thought". It is the way in which we think about the duration of things. In the remaining chapters it will become clear what Descartes thinks about the duration of

each kind of substance and how it is temporally manifested in accordance with each one's respective essential attribute.

Prior to examining time as it relates to both the material substance and to the thinking substance, Chapter II will consider the genesis of a time-paradox that evolves within the context of Descartes' doctrine of continuous creation. The primary concern of this doctrine is to establish the existence of God. Time, nevertheless, becomes an important issue. The creature in itself is nothing and has no power of conservation whereby it can continue to exist from one moment to the next. Hence, God's continuous creative activity must renew the creature in existence at each and every moment or else the creature would cease to exist and fall into nothingness. As regards time, each of these moments is independent and can be separated from the the moment before and the moment after. Since there is no necessary connection between any two moments, it would appear that these units cannot be conceived as contiguous units which form a true continuity, an unbroken unity. Is Descartes, then, guilty of a real contradiction or simply an apparent contradiction? Does Descartes, as some critics claim, draw continuous time from discontinuous moments?

What is at issue here in this chapter is whether Descartes' doctrine of continuous creation, upon which the critics base their thesis, does, in fact, establish the

discontinuity of time. One of the main points we will consider is the argument that, for Descartes, contiguity is identified with continuity. If this is true, what follows is that discontiguity is identified with discontinuity. Hence, since the moments are not necessarily connected, that is, they can be separated, they are discontiguous, and thus discontinuous. An examination of the texts will determine if the line of argument is valid.

In addition, does Descartes draw duration from moments that have no duration? The same critics who allege that time for Descartes is discontinuous, also presume that it is constituted by moments that have no duration. This chapter, then, will address itself to the thesis that: Descartes' theory of time is paradoxical, but the reader must be alerted to the fact that this thesis cannot be sustained or disproved by appealing to arguments based on the scattered texts presented by the critics. It can only be resolved by examining time and how it functions within the broader context of Descartes' metaphysical dualism and the scientific concerns which dominate his philosophical life. Our study will accomplish that resolution.

Chapter III will be directed to an examination of time as the "number of movement" insofar as it applies to the material substance. Initially, the chapter will examine the concept of 'movement' found in the pre-Principles period of Descartes. There are two reasons for considering this

period separately. The first is that in Descartes' early writings he espoused the existence of a vacuum and explained the movement of falling bodies in terms of the force of gravity. Secondly, prior to 1640 Descartes considered weight to be an objective quality in bodies and a factor in movement. Descartes abandoned both positions and he no longer believed in the existence of a vacuum nor did he consider weight an objective quality in bodies. After 1640 Descartes' definition of bodies now included only their extension and the displacement of their extended parts.

Given this geometrical concept of bodies, Descartes found it necessary to redefine motion. After 1640 Descartes conceived only local motion to be possible, defining it as a transference or instantaneous displacement of one part of matter by another part in the immediate vicinity. As our analysis will bear out, this concept has a myriad of implications that condition our understanding of time. In the pre-Principles period time played only a minimal role in Descartes' concept of movement. However, after he redefined bodies in the Principles time becomes a decisive factor in the explanation of local movement.

Descartes' theory of the instantaneous transmission of light plays a pivotal role in his philosophical system and within his physics. Consequently, this chapter will examine that theory apart from the concept of 'movement'. Part of that examination will include a consideration of what

Descartes means by the term 'instant', since it is the temporal condition for the transmission of light.

Chapter IV will shift from time as it relates to the material substance to a consideration of the temporality of the thinking substance as it is manifested in the mental events which constitute its duration. Descartes abandons the term 'instant' when he speaks about the thinking substance. The Cogito and all other truths are seen in that primary moment known as the 'present'. For Descartes, the 'present' has epistemological consequences. His metaphysics is formulated to define the thinking substance as an agent of knowing. It is from this perspective that we must approach the temporality of the thinking substance since its essence is limited solely to thought.

The Rules cannot be dismissed simply because they were never finished. Descartes offers a systematically developing philosophy, and the Rules are Descartes' initial attempt to set down a method for attaining truth in the sciences. While Descartes may have changed his thinking on some minor areas, he never rejected the fundamental precepts laid down in the Rules. Clearly enunciated in this work is the principle that there are only two means by which certitude is possible: intuition and deduction. Hence, the efficacy of the thinking substance as an agent of knowing is demonstrated when the mind employs these two mental operations. As mental events that constitute the

duration of the thinking substance, they reveal the manner in which Descartes thinks the soul's temporality can be and should be most powerfully expressed. In examining these two mental activities and their temporal implications, special attention will be given to the concept of the 'present'. Insofar as the past and future are parts of time, we will consider in detail the synthetic activity by which the mind coalesces the past and future with the present so as to constitute an unbroken continuum.

Since the thinking substance is the noetic foundation of Descartes' science, it is worth attempting to ascertain its ontological status and determine whether Descartes' metaphysics posits a permanent subject whose substantial identity is preserved in time. Science as a developmental intellectual event requires this.

Chapter V introduces an historical look at the meaning of time. It examines Book IV of Aristotle's Physics and Books XI and XII of the Confessions of St. Augustine. Their treatments of time will serve to support and clarify the interpretation offered by this study. The comparative analysis will demonstrate that one can scarcely deny Descartes' obvious affinity to both Aristotle's and Augustine's theories. In the case of Aristotle the parallels in language are striking. For both Aristotle and Descartes we find time described as the "number of movement" and a "measure" that can be applied to motion and the duration of

things. St. Augustine's treatment of time provides us with a theory that stresses the psychological aspect while it recognizes the objective reality of time as a property of created substances. This dual perspective of time is integral to Descartes' theory. For Descartes shares a belief that time is real, yet he acknowledges that the point of reference for understanding that temporality is the soul. Thus, Descartes defines time as a "mode of thought".

The comparative analysis will establish that the areas of similarity between Descartes and his two predecessors are pronounced. This lends credence to our claim that Descartes made use of their theories in his own philosophy.

The final chapter will serve to summarize the previous chapters and will justify our approach and the four goals we set out to accomplish. More importantly, it will establish that Descartes' theory of time can stand on its own merits as a coherent theory of time that is accommodated to his metaphysical dualism and to his more fundamental scientific goals.

CHAPTER I

THE NEW SCIENCE

A. A Mathematical Physics

The fabric of Descartes' philosophical system is tightly woven of diverse strands of thought whose meaning and value are determined by the manner in which they serve to complete the intended design. Because of this an understanding of the individual strands is conditioned by viewing the system as an integrated whole. Without that insight the meaning and significance of any one strand are obscured and ultimately become entangled and distorted. In view of this our intent is to examine time as it functions within the tapestry of Descartes' philosophical system. To do this it is necessary to determine the singular fundamental concern which provided the impetus for Descartes' philosophical endeavors. As a preliminary to the examination proper we propose to identify this dominant project which forms the central pattern of Descartes' philosophical system.

Descartes was an innovator and a man with a mission. At an early age it became apparent what direction that mission would take. Sometime in the year 1618, at the age of twenty-two, Descartes met Isaac Beeckman, a Dutch physician and engineer. Beeckman, himself a committed man, had a

vision of a new 'mechanical' philosophy that viewed the world as an order of atoms moving according to mathematic-mechanical laws. Descartes joined Beeckman in a brief apprenticeship in natural philosophy and mathematics. Together they believed they could construct a natural philosophy that would be a combination of mechanics and mathematics, a philosophy most properly called 'physico-mathematics'.¹ They never systematized their speculations. Influenced by Beeckman's work, Descartes pursued mathematical researches on his own.

The year of 1619 was significant for Descartes. In November of that year we are told that Descartes had a dream in which the Angel of Truth revealed that he was to devote his whole life to science, and that mathematics was the sole science that would provide a solution to all the secrets of nature.² The dream was the confirmation of his already held conviction that there could be one single universal science that included all the narrow sciences and that each of the sciences required the same certitude and the same method.³

The dream of a universal science perdured. Contrary to Aristotle, who believed that all the sciences required a different method of approach and analysis,⁴ Descartes believed that all the sciences were identical to wisdom and could be comprehended by the same method:

Il faut donc bien se convaincre que toutes les sciences sont tellement liees ensemble, qu'il est plus facile de

les apprendre toutes a la fois, que d'en isoler une des autres. Si quelqu'un veut chercher serieusement la verite, il ne doit donc pas choisir l'etude de quelque science particuliere; car elles sont toutes unies entre elles et dependent les unes des autres;⁸

The unity of all sciences would mean not only that there would be one method of approach and analysis, but more importantly, one criterion for certitude that would embrace all things knowable. Descartes' dream of unity was essentially a dream of certitude that would raise science from the level of hypothesis to the level of conclusions. He deprecated the common philosophers who were content with hypotheses and were committed to the thesis that the most that could be achieved in the field of physics was to say how things could be without proving that they could not be otherwise.⁶ Descartes adhered to the belief that there could be a science more certain than popular belief--admittedly an infinite work that no one man could achieve, yet possible.⁷ Mathematics held the key to that possibility:

Pour la physique, je croirois n'y rien savoir, si je ne savois que dire comment les choses peuvent etre, sans demontrer qu'elles ne peuvent etre autrement; car l'avant reduite aux mathematiques, c'est chose possible.⁸

Descartes believed that of all the sciences mathematics alone furnishes us with an illustration of self-evidence and certitude.⁹ If all the sciences could be comprehended as one, then whatever method was used in mathematics could justifiably be used in every scientific pursuit.

The dynamics of this method was the primary concern of

Descartes' earliest philosophical work which he entitled Rules for the Guidance of Our Native Powers. In it Descartes sets down a method for achieving truth and self-evident knowledge in the sciences. The method, which was to be more than provisional, consisted in intuition and deduction and was endemic to mathematics: "C'est a l'arithmetique et a la Geometrie seule parmi les sciences deja trouvers, que nous reduit l'observation de notre regle."¹⁰ The success of the mathematician in discovering truth and resolving problems led Descartes to propose that this method, which served the mathematician so well, could be utilized by every other discipline. All the other sciences, such as Astronomy, Music, Optics, Mechanics, among others, could employ the method since ultimately the questions in these sciences were questions that gave rise to problems about order and measure. While their objects are different, what they have in common are the various relationships or proportions among their objects.¹¹

Et si l'on y reflechit plus attentivement, on remarque enfin que seules toutes les choses ou l'on etudie l'ordre et la mesure se rattachent a la mathematique, sans qu'il importe que cette mesure soit cherchee dans des nombres, des astres, des sons, ou quelqu'autre objet; on remarque ainsi qu'il doit y avoir quelque science generale expliquant tout ce qu'on peut chercher touchant l'ordre et la mesure sans application a une matiere particuliere, et que cette science est appelee ...mathematique universelle, parce qu'elle renferme tout ce pourquoi les autres sciences, sont dites des parties de la mathematique.¹²

If all the questions that arise in any science are fundamentally mathematical questions, then the method of inquiry

used by the mathematician can be universally applicable by any scientist regardless of the discipline. The results of this will be the attainment of certitude. What is suggested in the Rules is that the principles of mathematics could be applied to the phenomena of nature. What is only implicit in the Rules becomes explicit later on in the Principles:

Que je ne recois point de principes en Physique, qui ne soient aussi receus en Mathematique...& que ces principes suffisent, d'autant que tous les Phainomenes de la nature peuvent etre expliquez par leur moyen.¹³

What Descartes has done is to reduce the laws of Physics to the laws of Mathematics.¹⁴ As Descartes' letter to Mersenne indicates, there is no intrinsic principle of action of forces that can explain the phenomena in nature. Nature acts in a mathematical manner, and therefore everything in nature can be explained by the laws of mathematics.¹⁵

If there is any question about the extent to which Descartes was committed to the belief that the universe could be read off in mathematical terms, it is resolved in Part I of the Principles:

Et il est certain que toutes les regles des Mechaniques appartiennent a la Physique...Car, par exemple, lors qu'une montre marque les heures par le moyen des roues dont elle est faite, cela ne lui est pas moins naturel qu'il est a arbre de produite ses fruits.¹⁶

As the text confirms, Descartes imposes a mathematical quality on the phenomena of nature. There is no distinction between living and non-living phenomena; all are subject to the laws of mathematics. Radical as this vision of reality may seem in contrast to Aristotle's vision, it was the only

one in Descartes' eyes, that would ensure the certitude that was demanded by any science conceived as wisdom.

J. Goodfield's observation captures it well: "Descartes answered Montaigne in the same way Plato answered Socrates, by anchoring down the concept of science on timeless geometrical foundations."¹⁷

B. The Metaphysical Foundation of Physics

Historically, perhaps too much emphasis has been placed on Descartes' metaphysics and not enough on his scientific concerns. Descartes' Discourse on Method and the Meditations remain the required reading in universities, while his scientific treatises are relegated to the school of scholars with scientific orientations. The metaphysical works of Descartes are an essential component of his philosophical system, but they play a subordinate role to his overall fundamental scientific project. Those who have studied Descartes in depth and considered his metaphysical treatises as parts of an integrated system acknowledge that Descartes proposes to be a metaphysician, but this for the sake of science itself.¹⁸

There is evidence to support this theory. The complete title of the Discourse written in 1637 is Discourse on Method of Rightly Conducting the Reason and of Seeking Truth in the Sciences. Primarily a metaphysical work, it was meant to be an introduction to Descartes' three scientific treatises: Optics, Geometry, and Meteorology. The Discourse was written

as an autobiographical account demonstrating how Descartes himself used the method for discovering the truth contained in the physical treatises that followed. Descartes hoped that those who learned of the method would appropriate it for themselves.¹⁹ As an introduction, the Discourse would validate the truth of the treatises; it would demonstrate that the conclusions reached were the result of a method grounded in principles of knowledge which could yield certitude. As history attests, the scientific works which Descartes hoped would be read were ignored, and the Discourse became the important work.

Four years after the Discourse, Descartes' major metaphysical work, the Meditations on First Philosophy, was published. Like the Discourse, it was a means to an end and not the end itself. Descartes' purpose in writing the Meditations was to provide a metaphysics that would serve as the foundation for his physics.²⁰ The mathematical nature of Descartes' physics demanded a metaphysics unlike Aristotle's, where all reality was grounded in a world of immaterial, indivisible, substantial forms. Such forms failed to meet the exigencies of a mathematical science whose principles and laws were to be applied to all the phenomena in nature. Motivated by his dream to establish a mathematical physics, Descartes proposed to establish a new metaphysics that would serve as the foundation for such a physics. Not wishing to openly reject Aristotle's metaphysics, he, nevertheless,

confided to Mersenne that this was his intent in writing the Meditations.²¹

After the Meditations was written Descartes spent the next few years writing the Principles. Wishing to solidify his metaphysics, Descartes proposed that this new work contain all the principles from which one could derive a knowledge of all the things in the world.²² The Principles was structured so that the first two parts were to form the ground for what followed in the last two parts. Hence, we find in Part I the principles of knowledge which included a metaphysics of the thinking substance as well as the three proofs for the existence of God. In Part II Descartes discusses the principles of material things. In Parts III and IV he treats of the visible world and the earth. The structure of the Principles is in keeping with Descartes' belief that science needs a firm metaphysical foundation. He prefaces the Principles with the well-known claim:

Ainsi toute la Philosophie est comme un arbre, dont les racines sont la Metaphysique, le tronc est la Physique, & les branches qui sortent de ce tronc sont toutes les autres.²³

As we have seen, Descartes' metaphysics was to be a foundation for his physics. As such his metaphysics would have to accommodate the mathematical kind of physics that he envisioned. While it is not our purpose to evaluate or defend each of the constitutional parts of Descartes' metaphysics, we can sketch out its basic components.

When it came to constructing a metaphysical foundation Descartes chose to depart from the traditional Aristotelian metaphysics. Epistemic considerations prompted Descartes' decision. The idea that reality could be explained in terms of substantial forms was inadmissible to Descartes. There was primarily one reason for this, and it can be traced to the fact that these forms failed to provide the necessary certitude. In Descartes' estimation these indivisible forms had a mysterious quality to them that made them elusive to the scientist. The human mind has no notion or particular idea to conceive them by. When we talk about them and assert their existence we are asserting something we do not conceive or understand.²⁴

Along with his rejection of the substantial forms was the disavowal of the reality of sensible qualities. Again, it was the question of the failure of these to yield certitude. As the analysis of the wax demonstrates, all sensible qualities appear confused and unclear.²⁵ Neither the substantial forms nor sensible qualities could provide a basis for certitude. What Descartes was looking for was something that was real and could give manifest and mathematical reasons for the phenomena in nature.²⁶

In the analysis of the wax Descartes finds the quality he is looking for. What remains in spite of the changes and what appears clear and distinct is extension.²⁷ Extension is the singular attribute that defines the material substance.

It is the sole quality that the scientist would have to work with in order to attain truth. Descartes' theory stripped the world of the animate and rejected physical action by imposing an inert quality on the material world. All natural action could be explained by mathematical reasons, since everything was fundamentally mathematical in nature. The Principles definitively establishes the quantitative nature of material substances. Descartes affirms that

...je ne connois point d'autre matiere ces choses corporelles que celle qui peut etre divisee, figuree, et meue en toutes sorte de facons, c'est a dire celle que les Geometres nomment la quantite.²⁸

The essentially mathematical nature of bodies impelled Descartes to offer a new definition of movement. Descartes rejected the common notion of movement as the action by which a body passes from one place to another. Movement is relative and essentially no different than rest, "ce qu'il y a de positif en la nature du mouvement se trouve aussi bien en celui que une dit vulgairement ne se point mouvoir."²⁹ The denial of action as an essential property of movement meant that Descartes must offer what he believes to be the true definition of movement. Movement he says is

...la transport d'une partie de la matiere, ou d'un corps du voisinage de ceux que le touchent immediatement, et que nous considerons comme en repos, dans le voisinage de quelques autres...Et je dis qu'il est le transport & non pas la force ou l'action qui transport, afin de montrer que le mouvement est toujours dans la mobile & non pas en celui que meut.³⁰

Descartes recognizes only one kind of movement and that is locomotion:

Nous pouvons aussi concevoir fort distinctement...diverse facons d'entendue, ou qui appartiennent a l'etendue, comme generalement toutes les figures, la situation des parties & leurs mouvemens, pourvue que nous les considerions simplement comme les dependances des substances ou elles font; & quant a ce qui est du mouvement, pourvue que nous pensions seulement a celui qui se fait d'un lieu en autre, sans rechercher la force qui le produit, laquelle toutefois j'essayerai de faire connoitre.³¹

It is local motion alone that is clear and distinct. All of the diverse phenomena that occur in the world can be explained by the diverse displacement of extended parts and the various dispositions and relations between the particles of matter.³²

The world was devoid of animation and physical action. Descartes' metaphysics projected a world of automata in which there was no difference between artifacts and natural bodies. The tree operated according to the same mechanical laws as a clock that tells time by the movement of its hands.³³ Descartes was convinced that nature was fundamentally quantitative. Hence, there was no natural action or intrinsic force that could explain the physical occurrences. Nature acts in a totally mathematical manner.

Bodies are extended entities whose relations and motions can be described according to mathematically quantified laws. This understanding of bodies according to such laws provides the only clear and distinct way such entities can be known. Hence, Aristotle's notion of "natural motion" as well as his notion of substantial forms is irrelevant. With the world reduced to extended quantity the mathematical model was intact. From the standpoint of the object the

metaphysical condition for certitude was fulfilled. What was needed was someone to apply the principles of mathematics to the phenomena of nature. This exigency could be met only by structuring a metaphysics of the thinking substance that would accommodate his mathematical physics. That substance would have to be in the world but not of the world. More importantly, it had to be empowered to know the world and to know it with certitude. Let us look at that thinking substance as an epistemic condition for Descartes' physics.

While we have seen Descartes come to discover the truth concerning the nature of material substances, the existence of the thinking substance is epistemically prior. As the Meditations confirms, it is the discovery of the truth of his own existence that constitutes the first principle of Descartes' philosophy. The discovery of this truth is the necessary prerequisite for the discovery of all other truths for three reasons. First of all, it answers the skeptics by demonstrating that truth exists. Secondly, it paves the way for the establishment of a criteria for truth that can be applied to all other questions regardless of the subject matter. Thirdly, it demonstrates that the thinking substance has the cognitive power to attain truth. As is apparent in the structure of the Meditations, Descartes first discovers the truth of his own existence and later he determines, through the analysis of the wax, that the nature of material substances is extension.³⁴

The Meditations, which Descartes intended to contain all the principles upon which he would build his physics, would not be complete without establishing God's existence. The import of this is made apparent by the fact that Descartes offers three separate proofs.³⁵ The certitude that Descartes hoped for could be absolutely guaranteed only by calling on an ultimate source of veridical appeal. Notwithstanding the fact that the thinking substance is empowered to attain the truth, he is fundamentally finite. The finitude is radical and cannot be overcome.³⁶ The truth of this is concretely manifested in those moments in which man doubts, forgets, is deceived and proves feeble of memory.³⁷ These limitations as expressions of man's finitude preclude his being the absolute source of truth. He cannot be certain of anything unless he knows God exists.³⁸ It is in the knowledge that God exists and has given man a faculty for discerning truth that the possibility of truth is guaranteed. The efficacy of the faculty is ensured provided that one affirms as true only that which is seen clearly and distinctly.³⁹ Moreover, God guarantees the reliability of memory in the process of deduction when the reasons have slipped out of present consciousness.⁴⁰

In this general overview of the thinking substance we have seen how Descartes has formulated his metaphysics so as to show the possibility of truth from the perspective of the knower. A more germane and ontological concern is to clarify

the nature of that substance from which all truths are generated. In the primary relationship of knower and known there inheres a unity by way of appropriation. The intellectual grasp of some aspect of reality becomes a part of the mental warehouse along with the other true ideas. Paradoxically, the unity is grounded in an ontological difference between the knower and the known.

There exists a radical polarity between the two kinds of substances. In defining material substances in terms of extension Descartes stripped the world of animism and power. To meet the exigencies of his mathematical physics he filled the world with inert extended objects. Because of the quantitative nature of phenomena, presumably the laws of nature could be expressed by mathematical formulations of geometrical relations between material particles. The world was knowable and could theoretically yield conclusions. Descartes had to make a decision. Either man's definition would include both body and soul, in which case he was a part of the world and assumed its determination; or, he would be defined solely in terms of his soul and retain his absolute freedom. Descartes chose the latter. In truth he says

...je connu de la que j'etais une substance dont toute l'essence ou la nature n'est que de penser & qui pour etre n'a besoin d'aucun lieu, n'y depend d'aucune chose materielle. En sorte que ce Moi, c'est a dire l'ame par laquelle je suis ce que je suis est entierement distincte du cors.⁴¹

What then could be said of the human body to which the soul was united except that it was like any other material

substance? The human body could in no way be conceived to have any intrinsic power of action. Descartes assumed a radical position and proposed that the human body was analogous to a machine that had certain parts and operated in accordance with certain mechanical laws.⁴² In contrast, the soul by which man is defined is the center of action:

Comme, lorsque je veux, que je crains, que j'affirme ou que je nie, je conçois bien alors quelque chose common le sujet de l'action de mon esprit.⁴³

The material substance is marked by its lack of power. The dynamic nature of the thinking substance is marked by its intrinsic cognitive power:

Car, que j'ai la faculte le concevoir ce que c'est qu'on nomme en general une chose, ou une verite, aucune pensee, il me semble que je ne tiens point cela d'ailleurs que de ma nature propre.⁴⁴

The material substance is projected as an object whose movements are determined according to mathematical laws. The thinking substance expresses his freedom as the subject of responsibility:

Mais, pour ce que est des inclinations qui me semblent aussi m'etre naturelles, j'ai souvent remarque, lorsque il a ete question de se faire choix entre les vertus & les vices, qu'elles ne m'ont pas moins porte ou au mal qu'au bien.⁴⁵

Finally, unlike the body, which is essentially divisible into parts, the thinking substance is without any parts:

...lors que je considere mon esprit, c'est a dire moi-meme en tant que je suis seulement une chose qui pense, je n'y puis distinguer aucunes parties, mais je me conçois comme une chose seule et entiere.⁴⁶

Whatever may be the limitations of Descartes' dualistic metaphysics it succeeds as a metaphysical foundation for his science. The world is knowable and the knower endowed with a natural power of understanding need only will to act on that power and to use it correctly. The ground has been laid for the fulfillment of Descartes' vision of a mathematical kind of physics.

C. Time

Our first effort has been to set the background for our central concern, which is to examine Descartes' thinking on time. We are able to give a general meaning to time as the measure of the duration of both material and thinking substances.⁴⁷ However, a more precise determination of its nature can be reached. That precision will be the result of viewing time in light of Descartes' metaphysical dualism. Since Descartes has a two-substance metaphysics, and time is a basic feature of both kinds of substances, then an account of a Cartesian theory of time must take this into consideration. It must explain the manner in which time is such as to be a property of each substance.

We should be able to find a coherency of thought between the different elements that constitute Descartes' philosophical system. The Cartesian theory of time should reflect and support the fundamental philosophical consideration of that system. It has been demonstrated in a general way how Descartes' metaphysical dualism accommodates his

primary scientific goals. Hence, one way to test the coherency of Descartes' theory of time in terms of its role in an integrated system is to test its coherency with the most immediately related element, Descartes' metaphysical dualism. Our study will do this. Later chapters will depart from a general notion of time and concentrate on time as an analogical concept. That examination will concentrate on the distinctions of time that reflect the distinctive properties of the two kinds of substances. This will determine if, and in what sense, Descartes' theory of time is coherent with his basic primary philosophical concerns.

Our present concern is more general. What is needed before examining time as an analogical concept is to give some general meaning to time as it presents itself in Descartes' philosophy. Descartes offers no clear definition of time. Yet the texts tell us several things about time. Time is one of those common sensibles like size, shape, place, and movement. These are naturally known. If you try to define them you only obscure them and cause confusion.⁴⁸ Descartes has more important things to say about time.

In a passage from the Meditations in which Descartes makes the distinction between imaginary or representative things and real things as extension, figure, number, etc., he places time in the category of real things:

...il y a des choses encore plus simples & plus universelles, qui sont vraie et existantes...De ce genre de choses est la nature corporelle en general, & son

entendue; ensemble la figure de choses entendue, leur quantite ou grandeur & leur nombre, comme aussi le lieu ou elles sont, le temps qui mesure leur duree & autre semblables.⁴⁹

There are three things Descartes says about time in this passage. Initially he tells us that time is universal. Descartes terms universal any singular idea of which we avail ourselves in order to think of all the individuals which have a certain similitude.⁵⁰ In the course of analysis we will determine what this similitude is insofar as time is predicated of both substances. Secondly, Descartes tells us that time is real. As the text indicates, time is as real as extension; it is an essential property of the existing substance insofar as that substance endures. Time is both universal and real. When we form the idea of time and apply it to all material things denoting their similitude, time is a universal. That conceptual universality has a counterpart in reality. It is important to keep this in mind because other texts to be considered later suggest that time is simply a construct of the mind.

The third and most salient point to note in the text is that Descartes identifies the real temporal property of things when he says that time measures the duration of things. Duration is common to all substances:

Par exemple, a cause qu'il n'ya point de substance qui ne cesse d'exister, lors qu'elle cesse de durer, la duree n'est distincte de la substance que par la pensee.⁵¹

Insofar as all substances exist, they endure, and insofar as they endure, their duration can be measured by time. By calling time a measure, Descartes introduces a quantitative aspect to the notion of time and similarly to the correlative concept of duration. Time can only be conceived as a kind of measure if there is something measurable, that is, a species of quantity. Descartes' definition of dimension implies this:

Par dimension nous n'entendons rien autre chose que le mode et le rapport sous lequel un quelconque est juge mesurable, en sorte que non seulement la longueur, la largeur et la profondeur sont des dimensions...la vitesse et ainsi d'une infinite d'autre choses de cette sorte.⁵²

Dimension is a species of quantity of which there are two kinds. Quantity is either discrete, like the point, or it is continuous, like spatial magnitude. Points are indivisible and are not per se measurable. As discrete quantity, they can be counted or they can be ordered in relation to other points. Continuous quantity, like the magnitude, is measurable, and it is the quality of continuity that presents itself as the measurable aspect of things.

Time can serve to measure the duration of things because duration presents itself as a species of continuous quantity. Duration is a real property of things since there is no substance that does not cease to exist when it ceases to endure. When we comprehend that duration it is conceived as kind of continuous quantity. Hence, time can function to measure that duration. This measurable aspect of duration

is articulated by Descartes when he says that "la duree est un mode ou une facon dont nous considerons cette chose en tant qu'elle continue d'etre." ⁵³

Wherever there is a continuum, there we find a measurable object that can be conceived in terms of more or less or of long or short. The measurable aspect of duration is made apparent in the practical order. We note that the movie lasted less than three hours. Or, similarly, we measure the duration of the movie as lasting a long time. Duration presents itself as a continuum, a kind of stretching out of existence that in some sense must be conceived as a species of magnitude. This is the case in all questions that consider the 'more' or 'less'. This is implied in the Rules:

Il faut noter ensuite que rien ne peut etre ramener a egalite que ce qui comporte le plus et le moins et que tout cela est compris sous le nom de grandeur. ⁵⁴

Everything that is measurable is a dimension that has the quality of spatial extension. Regardless of the subject matter, the exact determination of whether something is more or less can only be achieved "par une certain analogie avec l'entendu d'un corps figure." ⁵⁵ The possibility of measuring duration is grounded in the fact that duration is continuous, and therefore is analogous to extension. This aspect of duration is underlined in Descartes' letter to Burman:

Notre pensee...est etendue et divisible quant a la duree parce que sa duree peut etre divisee en parties. ⁵⁶

As an extended body with its continuous quantity is measurable, so too is duration. Just as an extended body is



measured by an appropriate standard of measurement such as the yardstick, so too is duration measured by a standard. That standard is time.

As we noted previously, Descartes offers no one clear-cut definition of time. From the foregoing texts we know that time is universal and real, and that it is a measure of duration. Another mathematical perspective of time emerges in the Principles in which we find Descartes saying that:

...le temps, par exemple, que nous distinguons de la duree prise en general, & que nous disons etre le nombre du mouvement, n'est rien qu'une certain facon dont nous pensons a cette duree, pource que nous ne concevons point que la duree des choses qui sont meuees soit autre que celle des choses qui ne le sont point.⁵⁷

There are several aspects of this passage that deserve attention. Initially, we should take cognizance of the fact that Descartes insists that time can be called a number of movement only if one understands that per se movement is not being numbered but merely movement insofar as it implies duration. Descartes makes this clear when he remarks that the duration of things moved is no different from the duration of things not moved. Time numbers duration and not specifically movement. Descartes' definition of time as a number complements his definition of time as a measure.

Duration as measurable is a species of dimension, and dimension, because it is a quantity, is numerable. Number simply functions to express that measure:

Enfin il faut remarquer que, quoique nous abstrayons ici des nombres les termes de la difficulté, pour en examiner la nature, néanmoins il arrive souvent que cette difficulté peut être résolue avec les nombres donnés, plus simplement que si on l'en avait abstraite; cela se produit à cause du double usage des nombres ainsi que nous l'avons déjà vu plus haut, les mêmes nombres expliquant tantôt l'ordre et la mesure.⁵⁸

When it is a question of measurement and the numbering of that measurement there must be some unit that acts as the standard of measurement:

On doit savoir aussi qu'au moyen d'une unité d'emprunt les grandeurs continues peuvent être ramenées à la quantité, parfois tout entières et toujours au moins en partie.⁵⁹

In the case of a true magnitude, either the metric unit or its United States equivalent serves as the standard of measurement. In the case of duration, the temporal unit serves as the standard by which one can measure the duration of things. Thus, a duration of ten minutes is measured by the temporal unit of a minute, ten hours by the temporal unit of an hour, ten days by the temporal unit of a day, etc.

If we retain the analogy that duration has with magnitude, we understand that as a true magnitude is measured as a unit, duration is also comprehended as an actual whole. In measuring a continuous magnitude of ten inches, we consider the object as a whole that is potentially divisible into parts or units of inches. Similarly, in measuring a duration of ten minutes, that duration is comprehended as an actual whole that is potentially divisible into units of minutes. When it is a question of measurement, the parts are

subsumed by the whole. The object of measurement is the quantity of the whole as Rule XIV indicates:

Si nous considerons, en effect les parties que forment le tout, on dit alors que nous comptons...si nous considerons le tout en tant que divise en parties, nous le mesurons; par exemple, nous mesurons les siecles par les annees, les jours, les heures, les minutes; mais, si nous comptons les minutes, les heures, les jours et les annees, nous finirons par remplir des siecles.⁶⁰

Thus, insofar as time functions as a number that measures duration, its object is per se the whole, that is, the actual unit conceived as a length of existence. Or more appropriately, it is the quantity of time in which one has continued to exist. Insofar as time numbers this quantity, it correspondingly measures it.

In light of what Descartes says in the Rules, it is possible to provide another mathematical perspective of time as a number: Number also functions to express order.⁶¹ This double function of number, that is, to express order and to measure, has its basis in the mathematical method which consists in the reduction of all questions of measure into questions of order:

On doit savoir aussi qu'au moyen d'une unite d'emprunt les grandeurs continues peuvent etre ramenees a la quantite parfois tout entieres et toujours au moins en partie; la quantite des unites peut ensuite etre disposee dans un ordre tel, que la difficulte, qui etait relative a la connaissance de la mesuree, ne depende plus enfin que de la consideration de l'ordre progres pour lequel ma methode est d'une grand secours.⁶²

What is measurable is orderable, and number functions to express both aspects. This rule can be applied to time

since time is a kind of number.

We have observed the manner in which time functions as a number that measures duration insofar as that duration presents itself as a continuity analogous to extension. Corresponding to the quality of extension as a spatial magnitude, duration, when comprehended as a whole, implies the divisibility of parts. In the case of duration, these parts take on the mode of 'before' and 'after', constituting a relationship of order. While the duration of substances is measured as an actual whole, its measurement is made possible because duration is fundamentally successive. That is, it is not simultaneous. It is constituted by a succession of moments related to each other in an order of 'before' and 'after'.

This aspect of duration is articulated in Descartes' correspondence with Arnauld. To Descartes' treatment of the duration of the soul in the third Meditation Arnauld had objected that the duration of a spiritual being was non-successive.⁶³ Descartes' response is emphatic in making the point that there is no distinction between the duration of thinking substances and that of material substances, both are characterized as successive:

Je ne connois pas autrement la duree successive des choses qui sont mues, ou meme celle de leur mouvement que je fais la duree des choses non mues; car le devant et l'apres de toutes les durees quelles qu'elles soient, me parait par le devant et par l'apres de la duree successive que je decouvre en ma pensee avec laquelle les autres choses sont coexistantes.⁶⁴

We are presented with a dual perspective of duration. On the one hand, duration is measurable because it is analogous to extension, "Notre pensee...est etendue et divisible quant a la duree".⁶⁵ On the other hand, as Descartes' response to Arnauld indicates, the extended unit is divisible into discrete parts, related to each other in an order of 'before' and 'after'. We are in the presence of a quantitative object that is both continuous and discrete; as such, it is both measurable and orderable. Time as a number functions to express both the measure and the order in the following manner:

A duration measured as a unit of ten days is divisible into parts that are related in a successive order. The first day comes before the second day which comes before the third day and after the first day, etc., until we reach the tenth day. Each day is singularly related to the other as either a 'before' or an 'after'. This is a concrete example of the mathematical method which consists in the reduction of measure to order. The applicability of the method is most appropriate in the case of duration. The essential constitution of duration is by nature that of order since it is successive. It is only after two or more of the units have followed in a successive order that they can be measured. If one were to inspect any measurement, it would be found to be grounded in a relationship of order.

To give further insight into the mathematical

perspective, we cannot ignore the countable factor and the relationship that the units have to one another. The relationship of order is the primary and essential relationship between the individual temporal units. While the relationship of temporal order implies a numerical assemblage of countable units, as countable units per se they are not necessarily related. Consider a duration that is measured as ten days. At each twenty-four hour interval we mark one day, two days, three days, etc. until we reach ten days, comprehending the totality as a unit in itself. While the units constituting the measure, insofar as they are countable units are related, the relationship is not essential. Their relationship is parallel to that of units in a numerical series where the 'two' is related to the 'one' to the extent that you cannot have a 'two' without a 'one', but you can have a 'one' without a 'two'. Similarly, you can have a 'three' without a 'four' but not a 'four' without a 'three'. By analysis one can see that, while the prior number in the series is included in the concept of the subsequent number, as 'four' includes 'three', the 'four' is the result of the addition of singular units each designated as one. The relationship is constructed by an external factor. In the numerical series neither the 'one' and 'two' nor 'three' or 'four' are correlative concepts. This is verified by the fact that the concept of 'one' is understood apart from the concept of 'two' as 'three' is understood as

unrelated to 'four'.

In the case of parts ordered one to another the relationship is essential. An analytic proposition will demonstrate the point. A rainy day is a wet day. The predicate is contained in the subject. The same holds true for the following proposition. The day before precedes the day after. The predicate adds nothing to the concept of the subject since it is essentially contained in the subject. 'Before' and 'after' are understood in terms of each other, and in this sense their relationship is essential. If one understands the concept of 'before' one understands that it is related to 'after' by virtue of its order. The relationship of parts ordered one to another is prior in the order of being to that of the relationship of parts constituting a numerical assemblage.

The point can be graphically illustrated:

Figure 1.

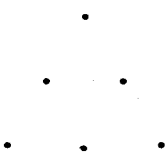
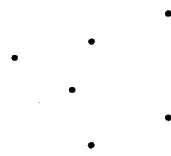


Figure 2.



In both Figure 1 and Figure 2 we have a numerical assemblage of six units. In Figure 1 the assemblage constitutes the intelligible geometric figure of a triangle. It does this because each of the points has a necessary position in relation to the other points. In Figure 2 the assemblage does not form any intelligible geometric figure for the reason that points are randomly placed. In Figure 1 we need

only inspect the order to apprehend a triangle. In other words, it is not the countability of the points that results in the figure of a triangle but the order of the points. Figure 2 lacks the relationship of order, hence it is not apprehended as an intelligible geometric figure.

To demonstrate the point further: I am seated at the piano with the intention of playing a piano sonata. Unable to remember the order of the notes I play a random selection of notes for the first few minutes. I am able to perceive each note in the sequence as having some sound and duration and can count them as one, two, three, four, etc. As an assemblage of sounds their relation to each other is extrinsic or accidental. As such, they do not blend harmoniously to form the desired melody. If, however, I play the notes in accordance with the musical score, they are played in a certain order in which each note has a necessary place and duration. It is not the simple assemblage of notes that constitutes the melody, it is the assemblage of notes in so far as each note is ordered one to another. In this sense, it may be said that the relationship of parts ordered one to another is prior to the relationship of parts constituting a numerical assemblage.

When it is a question of measurement, all numerical assemblages can be broken down to the relationship of order. This is the essence of what Descartes proposes in Rule XIV:

On doit savoir aussi qu'au moyen d'une unite d'emprunt les grandeurs continues peuvent etre ramenees a la quantite, parfois tout entieres et toujours au moins en partie; la quantite des unites peut ensuite etre disposee dans un ordre tel, que la difficulte qui etait relative a la connaissance de la mesure, ne depende plus enfin que de la consideration de l'ordre, progres pour lequel ma methode est d'une grand secours.⁶⁶

This rule can be translated in terms of time which numbers duration. Because duration is continuous time can serve to measure it. The temporal measurement is expressed by a cardinal number as ten minutes. Because the continuum of duration is made up of parts essentially related in a successive order of 'before' and 'after', time as a number expresses that order. This is done by means of an ordinal temporal unit. Thus, the units constituting the measure are clocked off as the first minute, second minute, third minute, etc. This successive order makes it possible to comprehend the assemblage of these units as a measured quantity. In other words, the first minute, second minute, third minute can be counted as one minute, two minutes, three minutes, etc. until the measured quantity of ten minutes is reached. As the measure depends on the order, so too does the cardinal number depend on the ordinal.

As measurable and orderable, duration is numerable. And time is the number. That which is numerable is numbered only if there is a numberer. This subjective aspect of time is punctuated in the Principles:

Ainsi, le temps, par exemple, que nous distinguons de la duree prise en general, & que nous disons etre le nombre du mouvement, n'est rien qu'une certain facon dont nous pensons a cette duree...⁶⁷

The Principles calls us to the fact that duration is numberable, time is the number and the mind does the numbering. The process of numbering is twofold. The mind must choose a temporal unit as a standard of measurement, as the minute, hour, day, etc. and do the actual numbering that denotes the order or measure. One of the objective elements intrinsic to the subjective process of numbering is the duration of things. The other is the temporal unit that serves as the standard of measurement:

Mais, afin de comprendre la duree de toutes les choses sous une meme mesure, nous nous ferons ordinairement de la duree de certains mouvemens reguliers qui sont les jours & les annees, & la nommons temps, apres l'avoir rien, hors de la veritable duree des choses, qu'une facon de penser.⁶⁸

In addition to the temporal units created by the astronomical system are those which are constructs of man:

C'est en effet quelque chose de reel que la pesanteur de corps, la vitesse, ou la division de siecle en annees et en jours; mais ce n'est pas quelque chose de reel que la division du jour en heures et en minutes, etc. Et cependant toutes ces choses sont equivalentes, si on les considere seulement sous le rapport de la dimension comme on doit le faire ici et dans les science mathematiques;⁶⁹

We would be mistaken were we to emphasize the distinction between the measurement of centuries, years, and days, and that of hours and minutes. What is more important is their commonality. Whether it be the movements of the heavens or the movements created by the hands of the clock, both serve

as standards of measurement.

Time as a mode of thought means that without the mind there would be no measurement of duration. And if duration is measured, a commonly accepted standard of measurement is applied. In the practical order, this objective element constitutes the general basis for measuring. In addition to this objective aspect of the measuring process is a subjective aspect that has two dimensions. The first is the choice of a standard of measurement, and the second is the interpretation of the measure.

Consider the question of a choice. Experience verifies that neither the movements of the heavens nor the movements of the hands of a clock are always used as temporal standards of measurement. The time it takes to drive from A to C does not have to be measured by the clock. Depending on the subjective circumstances, another standard of measurement may be equally appropriate. Rather than compare the duration of a drive from A to C to the movements of a clock (ten minutes), it may be compared to the length of duration it takes to cycle from A to M. It will take as long to drive to the drugstore as it does to cycle downtown. The choice of a unit of measure reflects the purpose of the measurer and for that reason an objective standard of measure need not be used. What is necessary is that some movement be chosen as the standard of measurement. Whether that be the movements of the heavens which create the days and years, or the movements

of the hands of a clock which generate the minutes and hours, or an arbitrary movement such as cycling, all may be regarded as standards of measurement.

The second dimension of the subjective aspect of time is disclosed in the process of interpretation or evaluation of the measure. For the scientist, a movie on microbes that has a duration of two hours may seem to have lasted a short time. For the dancer, whose interests are far removed from microbes, the same movie may be interpreted as having lasted a long time. In both cases, the evaluation of the objective standard of measurement (two hours) is grounded in subjectivity. Descartes himself alludes to this factor of measurement. In his hopes for utilizing the method he has come to discover for attaining truth, he bemoans the fact that it must be done in "la court duree de ma vie".⁷⁰ How many years is short: forty, fifty, perhaps seventy? The temporal unit remains objective, the interpretation of that remains subjective.

This brings us back to our initial premise. Time measures the duration of both kinds of substances. The successive mode of that duration draws them into a relationship to one another in respect of 'before' and 'after'. Their coexistence in these moments means that the physical events taking place within the universe are simultaneous with any mental events. At the same time that some phenomenon occurs in the world the substance can intellectually and

volitionally react to it. This indicates that the thinking substance, like the material substance, exists in the world, and in that sense is an object. There is a unity between the two kinds of substances. Both the thinking substance and the material substance coexist in the world. There is another dimension to that unity. It is reflected in the fact that both kinds of substances share a common measurement of their diverse types of duration. In spite of the unity that exists between the thinking substance and the material substance, a difference remains. For while the thinking substance is an object, it is also a knowing subject. Its successive mode of duration must, it seems, reflect that characteristic.

The two kinds of substances are radically heterogeneous. The metaphysical foundation of Descartes' science was structured in accordance with the exigencies of his mathematical physics. Descartes fashioned a world of material substances that were essentially characterized by extension. In doing so he provided the mathematical model for his physics. The thinking substance that coexisted with these spatial entities was defined solely in terms of thought. Defined in this way, the thinking substance possessed a dynamic quality that was absent in material substances. It was that dynamic nature in contrast to the inert mathematical nature of the material substance that established the thinking substance as a knower able to

comprehend the phenomena in nature in terms of mathematical relations. From an epistemic standpoint, Descartes' metaphysical dualism served him well.

That metaphysical dualism cannot be ignored when it comes to the question of time. Material substances and thinking substances share a successive mode of duration, and time measures that duration. Given the radical distinction between the two kinds of substances, their duration cannot be manifested in the same way. Nor does it seem that time which measures their duration can be predicated of both substances univocally. Rather, it is our intent to show that a precise understanding of time warrants a perspective that views time as an analogical concept. We will see that within the philosophical system of Descartes there is a kind of static time and lived time that corresponds to the two separate substances. Further, we will see if, and in what manner, the polarity between the two modes of time is viable in terms of Descartes' vision of a universal mathematical kind of physics.

NOTES - CHAPTER I

¹John A. Schuster, Descartes' Mathesis Universalis: 1619-28, Descartes: Philosophy, Mathematics and Physics, ed. Stephen Gaukroger (Sussex 1989), p. 48.

²Jacques Maritain, The Dream of Descartes (New York 1944), p. 21. An analysis of the dream is given in G. Milhaud's Descartes savant (Paris 1922), p. 47ff.

³Descartes, Correspondance publiee avec une introduction et des notes par Charles Adam et Gerard Milhaud (Paris 1936-63). A Beeckman, 23, April, 1619. I, p. 14. References will be made to this edition only in some cases in which the original letter is written in Latin and will be annotated as follows: E.G. A Beeckman, 23, April, 1619, A.M. I, p. 14.

⁴Aristotle, Metaphysics, al, 995a, 15-20, The Basic Works of Aristotle, ed. Richard McKeon (New York 1968), p. 715.

⁵Oeuvres et lettres, texte presentee par Andre Bridoux, 2nd ed., Bibliothèque de la Pleiade (Bruges 1952), Regle I, p. 38. (A.T. edition contains only the Latin version of the Regles.) Cited hereafter as Pleiade. The English translations of the French will be cited according to the Haldane and Ross edition when applicable and when the translation is contained in that edition. The Philosophical Works of Descartes, Elizabeth S. Haldane and G.R.T. Ross (Cambridge 1969), Vol. I, p. 2. "Hence we must believe that all the sciences are so interconnected, that it is much easier to study them all together than to isolate one from all the others. If, therefore, anyone wishes to search out the truth of things in serious earnest, he ought not to select one special science; for all the sciences are conjoined with each other and interdependent": cf. Oeuvres de Descartes, C. Adam et Tannery, eds. (Paris 1897), Principes. Preface, p. 14. Subsequent references will be to this edition unless otherwise indicated and will be annotated as follows: E.G. Prin. Pre. A.T. IX, p. 14.

⁶A Mersenne, 11, March, 1640, A.T. III, p. 39; A Fromondus, A.M. II, p. 16.

⁷A Beeckman, 23, April, 1619, A.M. I, p. 14.

⁸A Mersenne, 11, March, 1640, A.T. III, p. 39. The English translations of the letters, when possible, will be taken from the Anthony Kenny edition. Descartes' Philosophical Letters, Trans. by Anthony (Oxford 1970), pp. 70-71. "...I would think I knew nothing in Physics if I could only say how things could be, without proving that they could not be otherwise. This is perfectly possible once one has reduced everything to the laws of mathematics."

⁹Regle II, Pleiade, p. 14.

¹⁰Regle II, Pleiade, p. 41. H.R. I, p. 4. "...if we reckon correctly, of the sciences already discovered, Arithmetic and Geometry alone are left, to which the observance of this rule reduces us."

¹¹Regle IV, Pleiade, p. 50.

¹²Ibid. H.R., p. 13. "But as I considered the matter carefully it gradually came to light that all those matters only were referred to Mathematics in which order and measurement are restricted as these are to no one special subject matter. This, I perceived, was called 'Universal Mathematics,' not a far designation, but one of long standing which has passed into current use, because in this science is contained everything on account of which the others are called parts of Mathematics." cf. Discours de la methode, A.T. VI, pp. 19-20.

¹³Prin. II, 64, p. 101. H.R., p. 269. "That I do not accept or desire any other principle in Physics than in Geometry or abstract Mathematics, because all the phenomena of nature may be explained by their means."

¹⁴A Mersenne, 11, March, 1640, A.T. III, p. 39.

¹⁵A Mersenne, 20, February, 1639, A.T. II, p. 525.

¹⁶Prin. IV, 203, A.T. IX, p. 321. H.R. I, pp. 299-300. "And it is certain that there are no rules in mechanics which do not hold good in physics...for it is not less natural for a clock, made of the requisite number of wheels, to indicate the hours, than for a tree which has sprung from this or that seed, to produce a particular fruit."

¹⁷June & Toulmin Stephen Goodfield, The Discovery of Time (London 1965), p. 80.

¹⁸ Etienne Gilson, La doctrine cartesienne de la liberte et la theologie (Paris 1912), pp. 441-442; Charles Adam, Oeuvres de Descartes (Paris 1897-1913), XII, p. 143; Lucien Levy-Bruhl, History of Modern Philosophy (Chicago 1899), p. 7; Roger Lefevre, Le criticisme de Descartes (Paris 1958), p. 251; Louis Liard, Descartes (Paris 1882), p. 93.

¹⁹ A Mersenne, 27, February, 1637, A.M. I, p. 328.

²⁰ I Meditation, A.T. IX, p. 13.

²¹ A Mersenne, 28, January, 1641, A.T. III, p. 291.

²² Prin.-Pre. A.T. IX, pp. 10-11.

²³ Ibid. p. 14. H.R., p. 211. "Philosophy as a whole is like a tree whose roots are metaphysics, whose trunk is physics, and the branches are all the other sciences."

²⁴ A Mersenne, 26, April, 1643, A.T. III, p. 649; A Regius, January, 1642, A.T. III, p. 491; Descartes a Morin, 13, July, 1638, A.T. III, p. 200; Prin. IV, 198, A.T. IX, p. 317; A Mersenne, 28, October, 1640, A.M. IV, p. 183. See Etienne Gilson's Etudes sur le role de la pensee medievale dans la formation du systeme cartesien (Paris: J. Vrin, 1975), pp. 141-190, for a standard account of Descartes' rejection of Aristotle's theory of forms.

²⁵ III Med. A.T. IX, p. 164; cf. Prin. IV, 197, A.T. IX, p. 316.

²⁶ A Regius, January, 1642, A.T. III, p. 491.

²⁷ II Med. A.T. IX, p. 24.

²⁸ Prin. II, 64, A.T. IX, p. 102. "I recognize no kind of matter in corporeal objects except that which can be divided, figured, and moved in all sorts of ways, that is, that which the geometers call quantity."

²⁹ A Clerselier, 17, February, 1645, A.T. IV, p. 187. "...whatever there is positive in the nature of movement is found as well in that which one says is not moving"; cf. Prin. II, 13, A.T. IX, p. 70; Prin. II, 30, A.T. IX, p. 79.

³⁰Prin. II, 25, A.T. IX, p. 76. H.R. I, p. 266. "... the transference of one part of matter or one body from the vicinity of those bodies that are in immediate contact with it, and which we regard as in repose, into the vicinity of others. And I say that is the transportation and not either the force or the action which transports, in order to show that the motion is always in the mobile thing, not in that which moves."

³¹Prin. II, 65, A.T. IX, pp. 54-55. H.R. I, pp. 246-247. "We shall similarly best apprehend the diverse modes...of extension, or which pertain to extension, such as all figures, the situation of parts and their movements, provided that we consider them simply as modes of the things in which they are, and as for motion we shall best understand it, if we inquire only about locomotion, without taking into account the force that produces it, which I shall nevertheless endeavour to set forth in its own place."

³²Prin. II, 23, A.T. IX, p. 75.

³³Prin. IV, 203, A.T. IX, p. 322.

³⁴II Med. A.T. IX, pp. 19-24.

³⁵Meditation III contains two proofs and Meditation V one proof.

³⁶Descartes a Hyperaspistes, August, 1641, Pleiade, p. 1134.

³⁷IV Med. A.T. IX, p. 49; II Med. A.T. IX, p. 19; I Med. A.T. IX, p. 17, 24-25; Regle VII, Pleiade, p. 58.

³⁸III Resp. A.T. IX, p. 152; IV Resp. A.T. IX, p. 230.

³⁹II Resp. A.T. IX, pp. 113, 116; III Resp. A.T. IX, p. 147; IV Med. A.T. IX, p. 43; Prin. I, 30, A.T. IX, p. 38; Prin. IV, 206, A.T. IX, p. 324; Disc. A.T. VI, pp. 38-39.

⁴⁰V Med. A.T. IX, pp. 55-56; Prin. I, 13, A.T. IX, pp. 30-31.

⁴¹Disc. A.T. VI, pp. 32-33. H.R. I, p. 101. "From that I knew that I was a substance the whole essence or nature of which is to think and that for its existence there is no need

of any place, nor does it depend on any material thing. So that this 'me', that is to say, the soul by which I am what I am, is entirely distinct from body"; cf. II Med. A.T. IX, pp. 25-26; III Med. A.T. IX, pp. 35-36, 39; IV Resp. A.T. IX, pp. 227-228.

⁴²VI Med. A.T. IX, p. 195.

⁴³III Med. A.T. IX, p. 29. H.R. I, p. 159. "For example in willing, fearing, approving, denying, though I always perceive some thing as the subject of the action of my mind..."

⁴⁴Med. A.T. IX, p. 29. H.R. I, p. 160. "...for as I have the power of understanding what is called a thing, or a truth, or a thought, it appears to me that I hold this power from no other source than my own nature.

⁴⁵III Med. A.T. IX, p. 30. H.R.I., p. 161. "But as far as natural impulses are concerned, I have frequently remarked, when I had to make active choice between virtue and vice, that they have often enough led me to the part that was worse."

⁴⁶VI Med. A.T. IX, p. 68. H.R. I, p. 196. "When I consider the mind, that is to say, myself inasmuch as I am only a thinking thing, I cannot distinguish in myself any parts, but apprehend myself to be clearly one and entire." cf. A Mersenne, 30, July, 1640, A.T. III, p. 124; Prin. I, 60, A.T. IX, p. 99; A Elizabeth, 28, June, 1643, A.T. III, p. 694; Descartes a Hyperaspistes, August, 1641, Pleiade, p. 1136.

⁴⁷I Med. A.T. IX, p. 15.

⁴⁸A Mersenne, 16, October, 1639, A.T. II, p. 587.

⁴⁹I Med. A.T. IX, p. 15. H.R. I, p. 146. "...there are at least some other objects yet more simple and more universal, which are real and true...To such a class of things pertains corporeal nature in general, and its extension, the figure of extended things, their quantity or magnitude and numbers, as also the place in which they are, the time which measures their duration, and so on."

⁵⁰Prin. I, 59, A.T. IX, p. 50.

⁵¹Prin. I, 62, A.T. IX, p. 53. H.R. I, p. 245. "For example, because there is no substance that does not cease to exist when it ceases to endure, duration is only distinct from substance by thought."

⁵²Regle XIV, Pleiade, p. 102. H.R. I, p. 61. "By dimension I understand nothing but the mode and aspect according to which a subject is considered to be measurable. Thus it is not merely the case that length, breadth and depth are dimensions...speed is a dimension of motion, and there are an infinite number of similar instances."

⁵³Prin., I, 55, A.T. IX, p. 49. H.R. I, p. 241. "...the duration of each thing is a mode under which we shall consider this thing insofar as it continues to exist."

⁵⁴Regle XIV, Pleiade, p. 97. H.R. I, p. 56. "Next, we must mark that nothing can be reduced to this uniformity, save that which admits of a greater and a less, and that all such matter is included under the term magnitude."

⁵⁵Regle XIV, Pleiade, p. 98. H.R. I, p. 56. "...in a certain way analogous to the extension of a body possessing figure."

⁵⁶Entretien avec Burman, Pleiade, p. 1358. English translation found in the following: John Cottingham, Descartes' Conversation with Burman, translated with Introduction and Commentary (Oxford 1976), p. 6. "Our thought...is extended and divisible as to its duration because its duration can be divided into parts."

⁵⁷Prin. I, 57, A.T. IX, pp. 49-50. Haldane and Ross are not used here because they translate "nombre" as measure. This is an inaccurate translation since number and measure are not synonymous for Descartes. My translation is as follows: "...the time, for example, that we distinguish from duration taken in general and that we say to be the number of movement, is only a certain way of conceiving that duration, provided that we do not conceive of the duration of things which are moved as being different from that of things which are not."

⁵⁸Regle XVI, Pleiade, pp. 109-110. H.R. I, p. 68. "Finally, it must be noticed that even though here, in order to examine the nature of the difficulty, we abstract the terms involved from certain numerical complications, it yet often happens that a simpler solution will be found by

employing the given numbers than if we abstract from them. This is due to the double function of numbers, already pointed out, which use the same symbols to express now order, and now measure."

⁵⁹Regle XIV, Pleiade, p. 105. H.R. I, p. 64. "We must likewise bear in mind that, by the help of the unit we have assumed, continuous magnitudes can sometimes be reduced in their entirety to numerical expressions, and that this can always be partly realized."

⁶⁰Regle XIV, Pleiade, p. 102. H.R. I, p. 61. "For if we proceed by taking part after part until we reach the whole, the operation is then said to be counting, whereas if conversely we look upon the whole as something split up into parts, it is an object which we measure. Thus we measure centuries by years, days, hours, and moments, while if we count up moments, hours, days, and years we shall finish with a total of centuries."

⁶¹Regle XVI, Pleiade, p. 110.

⁶²Regle XIV, Pleiade, p. 105. H.R. I, p. 64. "We must likewise bear in mind that, by the help of the unit we have assumed, continuous magnitude can sometimes be reduced in their entirety to numerical expression, and that this can always be partly realized. Further, it is possible to arrange our assemblage of units in such an order that the problem which previously was one requiring the solution of a question in measurement, is now a matter merely involving an inspection of order."

⁶³Arnauld a Descartes, 4, June, 1648, Pleiade, p. 1304.

⁶⁴A Arnauld, 29, July, 1648, Pleiade, p. 1309. Kenny is not used here because he translates "devant" and "apres" as "earlier" and "later," which denote temporal succession. Descartes is not stressing temporal order, but is referring to that which time measures, duration. Because duration is analogous to extension, it is more accurate to translate "devant" and "apres" as "before" and "after," since they denote position. My translation is as follows: I conceive the successive duration of things that move and of motion itself, no differently from that of things that do not move; for before and after in any duration are known to me by the before and after of the successive duration that I detect in my thought, with which other things co-exist." cf. III Med. A.T. IX, pp. 38-39.

⁶⁵Ent. avec Burman, Pleiade, p. 1358. Cottingham, p. 6.
 "Our thought...is extended and divisible as to its duration."

⁶⁶Cf. footnote no. 62.

⁶⁷Cf. footnote no. 57.

⁶⁸Prin. I, 57, A.T. IX, p. 50. H.R. I, p. 242. "But in order to comprehend the duration of all things under the same measure, we usually compare their duration with the duration of the greatest and most regular motions, which are those that create years and days, and these we term time. Hence, this adds nothing to the notion of duration, generally taken, but a mode of thinking."

⁶⁹Regle XIV, Pleiade, p. 103. H.R. I, p. 62. "Weight is indeed something real existing in a body, and the speed of motion is a reality, and so with the division of the century into years and days. But it is otherwise with the division of the day into hours and moments, etc. Yet all these subdivisions are exactly similar if considered merely from the point of view of dimension as we ought to regard them both here and in the science of Mathematics."

⁷⁰Disc. A.T. VI, p. 3. My translation is as follows:
 "...the short duration of my life."

CHAPTER II

THE PARADOXICAL NATURE OF TIME

We have seen that time functions as a measure of duration insofar as duration presents itself as a continuous species of quantity. Time also functions as a number for duration insofar as that duration is constituted by parts ordered one to another as 'before' and 'after'. Duration is measurable, it is numerable. It is comprehended as both continuous quantity and discrete quantity. Similarly, time as a mode of thought by which we think about that duration is both continuous and discrete. This dual perspective of time and duration evokes two questions. The first question concerns the nature of the unity of the moments insofar as they are arranged to form a continuous whole. A second question is directed to the nature of the individual moment as a discrete unit.

Objections regarding Descartes' theory of time have been directed at these two questions. It is important for this study to establish if the objections are justified since it affects our final evaluation as to whether Descartes has a coherent theory of time. However, at this stage of the study no definitive resolutions of the issues can be offered. These will follow only as a result of our

analysis of Descartes' theory of time as it functions within the context of his overall philosophical system. The germane concerns of this chapter are limited to an introduction to the genesis of the objections and to an assessment of the evidence offered by the commentators in support of their claims. Let us begin with the introduction.

A. Continuous Creation

The genesis of these two questions can be traced to Descartes' doctrine of continuous creation. The import of the passage justifies its citation:

Et encore que je puisse supposer que peut-etre j'ai toujours ete comme je suis maintenant, je ne saurois pas pour cela eviter la force de ce raisonnement, et ne laisse pas de connoitre qu'il est necessaire que Dieu soit l'auteur de mon existence. Car tout le temps de ma vie peut etre divise en une infinite de parties, chacune desquelles ne depend en aucune facon des autres; et ainsi de ce qu'un peu auparavant j'ai ete, il ne s'ensuit pas que je doive maintenant etre, si ce n'est qu'en ce moment quelque cause me produise et me cree, pour ainsi dire, derechef, c'est-a-dire me conserve. En effet c'est une chose bien claire & bien evidente a ceux qui considereront avec attention la nature de temps qu'une substance, pour etre conserver dans tous les moments qu'elle dure, a besoin du meme pouvoir et de la meme action qui serait necessaire pour la produire et la creer tout de nouveau si elle n'etait point encore. En sorte que la lumiere naturelle nous fait voir clairement que la conservation & la creation ne different qu'au regard de notre facon de penser & non point en effet.¹

In the following texts we see that conservation is defined in terms of continuous creation:

Car, tout de meme que, bien que j'eusse ete de toute eternite, et que par consequent il n'y eut rien eu avant moi, neanmoins, parce que je vois que les parties du temps peuvent etre separees les unes d'avec les

autres et qu'ainsi, de ce que je suis maintenant, il ne s'ensuit pas que je doive être encore après, si, pour ainsi parler je ne suis créé de nouveau à chaque moment par quelque cause, je ne ferais point difficulté d'appeler efficiente la cause qui me crée continuellement en cette façon, c'est-à-dire me conserve.²

As the texts indicate, Descartes' argument for the existence of God is predicated on the fact that there must be a cause who creates and conserves the substance since each of the moments of time in which the substance exists can be separated and are reciprocally independent of one another. The separation of the moments is the manifestation that the limited essence of the substance does not contain existence. Moreover, it attests to the fact that the substance lacks a principle of autocontinuation since it lacks the essential power to exist in any single moment. For this reason God must not only create the substance in the first moment in which it exists but must continue his creative action if the substance is to continue to exist.

According to M. Gueroult, Y. Belaval, and others who follow them, Descartes' doctrine of continuous creation clearly establishes the discontinuity of time.³ Gueroult's comment expresses this thesis:

Ayant démontré que Dieu est nécessairement l'auteur de moi-même, en vertu de la création continuée, ayant prouvé la création continuée par l'indépendance absolue des diverses parties de temps de ma vie, Descartes paraît bien soutenir la thèse de la discontinuité du temps.⁴

If this is the fundamental mode of time and duration it is contradicted in the order of experience where time and

duration are experienced as a continuum. Moreover, Descartes himself conceives duration as continuous and underlines this aspect when he defines duration as a mode under which we continue to exist.⁵ This is a continuity analogous to extension taken as an unbroken whole.⁶

Descartes appears to have a paradoxical view of time and duration. On the one hand, time and duration are made up of a sequence of separate and independent moments, none of which is necessarily connected to the other. Contrary to this view, time and duration are comprehended as a whole that is constituted by moments necessarily connected to each other. It seems we are confronted with schism and organization, diachrony and synchrony, and discontinuity and continuity. It is by no means certain, however, that this dualism translates into a real contradiction. Nor is it certain that Gueroult is correct when he suggests that Descartes has a paradoxical view of time in that he draws continuous time from a repetition of discontinuous moments.⁷

B. Discontinuity - Continuity

In order to sustain Gueroult's allegation it is necessary to give evidence that time, for Descartes, is discontinuous. Without providing any textual evidence, Gueroult claims that discontinuity is defined in terms of separation, reciprocal independence, and contingency and since the moments of time have these three characteristics, they are discontinuous.⁸ The texts on continuous creation

do not support the claim.

The texts do not say that the moments are actually divided nor actually separated. What the texts do say is that the time of my life "can be divided into an infinite number of parts" and that the parts of time "can be separated one from another." There is a distinction between what is actually divided and separated and what is only potentially divisible and separable. While actuality implies potentiality, what is potential does not necessarily imply actuality.⁹ That distinction, however, seems to have been overlooked by Gueroult.

Y. Belavel appears to maintain the same line of thinking as Gueroult, noting that the separation and independence of moments implies their discontinuity.¹⁰ His reasoning is based on his claim that Descartes does not distinguish the contiguous from the continuous, and since the moments are separated and reciprocally independent, that is not contiguous, they do not constitute a true continuity analogous to the continuity of a line as an unbroken unity. The discontiguity of the moments establishes their discontinuity.¹¹ In order for that claim to be sustained it must be shown that, for Descartes, the contiguous is identical to the continuous. Here are the texts on which Belavel bases his claim:

(A) This is Descartes' definition of contiguity.

Mais je n'ai jamais vu qu'elle (la superficie) fuit le terme du corps; au contraire, je croi qu'elle

peut fort proprement etre appelee l'extremite, tant du corps contenu que de celui qui contient, au sens que l'on dit que les corps contigus sont ceux dont les extremités sont ensemble. Car, de vrai, quand deux corps se touchent mutuellement, ils n'ont ensemble qu'une meme extremite, qui n'est point partie de l'un ni de l'autre, mais qui est le meme mode de tous les deux.¹²

(B) This is Descartes' definition of continuity.

Des lors, peu importe comment les autres definissent continu et contigu: pour moi, je dis qu'il y a continuité lorsque les surfaces de deux corps sont jointes d'une maniere tellement qu'ils entrent simultanément en mouvement ou en repos...Ceux qui se comportent autrement, sont contigus.¹³

Implicitly Belavel seems to be drawing from these two texts the following conclusions: When Descartes says in (B) that when the "surfaces of two bodies are so immediately joined that the two begin to move and come to rest simultaneously, they are continuous," he implies that the continuous bodies are actually bodies whose "surfaces" are really one surface. Since (A) says that "surface" can quite properly be called "extremity", then the "two surfaces" (B) are really the one "extremity" mentioned in (A). The point Belavel seems to be making is that the reason why the two bodies move and come to rest simultaneously (in which case they are continuous) is that their extremities are one and the same. But this has not been proven, it has merely been stated.

Although neither the term 'contiguity' or 'continuity' is used in Descartes' letter to Mersenne, Belavel offers it as Descartes' definition of continuity based on contiguity.

Here is the text Belavel cites from that letter:

Pour la superficie que j'ai dit ne faire point partie du pain ni de l'air qui est autour, elle ne differe en rien du locu Aristotelicus des echoles, ni de toutes les superficies que considerent les Geometres, excepte en l'imagination de ceux qui ne les concoivent pas comme ils doivent, & qui supposent que superficies corporis ambientis soit une partie du cors circoniacent.¹⁴

What the text establishes is that circumjacent bodies have a common extremity, and that extremity is not a part of one or the other, but the place of contact with other bodies. Belavel insists that such contact (contiguity) establishes their continuity.¹⁵ There is no justification on the basis of this text to consider, as Belavel seems to do, the following proposition to be analytic: What is contiguous is continuous. Rather than supporting his theory, the text may, in fact, weaken it. Since Belavel seems to be arguing that the contiguous is identical to the continuous, and that Descartes' definition of contiguity is identical to Aristotle's, the truth of the proposition must be based on the assumption that for Aristotle the contiguous is identical to the continuous. Is this the case?

Here is Aristotle's definition of contiguity: a thing that is in succession and touches is contiguous.¹⁶ Here is Aristotle's definition of continuity:

The continuum is a subdivision of the contiguous. Things are called continuous when the touching limits of each other become one and the same and are, as the word implies, contained in each other; continuity is impossible if these extremities are two. This definition makes it plain that continuity belongs to things that naturally in virtue of their mutual contact form a unity.¹⁷

Aristotle then proceeds to qualify and explain exactly what relationship the contiguous has with the continuous. It is not one of identity:

And if there is continuity there is necessarily contact, but if there is contact, that alone does not imply continuity; for the extremities of things may be together without necessarily being one; but they cannot be one without being necessarily together.¹⁸

An analysis of the texts shows the following:

Aristotle's definition of contiguity is distinguished from his definition of continuity in this manner: His definition of contiguity is defined simply in terms of contact between bodies whose extremities may be together without being one. Continuity is defined not only in terms of contact but contact between bodies whose extremities are one and the same in the sense that the touching limit is common to both. Aristotle's definition of contiguity is different from that of continuity; his definition of continuity is simply Descartes' definition of contiguity which is based on a common extremity.

While it is true that Aristotle's definition of continuity and Descartes' definition of contiguity have something in common--both require two things becoming one--Belavel has not proved the point that the text was intended to make. This for the reason that his argument is based on two false assumptions. The first assumption is that Descartes' definition of contiguity is identical to Aristotle's definition of contiguity (Descartes, it seems,

was incorrect in thinking that it was). The second assumption is that Aristotle's definition of contiguity is identical to his (Aristotle's) definition of continuity. If these were true, it could be argued that since Descartes' definition of contiguity is identical to Aristotle's, and Aristotle's definition of contiguity is identical to his definition of continuity, then Descartes' definition of contiguity is identical to his definition of continuity. However, as the texts demonstrate, these assumptions are not true, and Belavel's argument cannot be sustained.

Descartes' definition of continuity differs from Aristotle's. According to Aristotle, things are continuous simply by virtue of the fact that their extremity is one and the same so that they are necessarily connected. How does Descartes' definition of continuity imply something other than Aristotle's? Let us reconsider the original texts (A) and (B) that Belavel used as evidence that the contiguous is identical to the continuous. In (A) Descartes defines contiguity solely in terms of a common boundary. In (B) we note that when Descartes defines continuity he says that the bodies are so joined that when they move it is in a single motion and when they come to rest they do so simultaneously. If they act otherwise they are contiguous. It is not quite clear exactly what Descartes means by this last statement. Rather than identify contiguity with continuity it seems that he wishes to distinguish the two.

Based on what he says in texts (A) and (B) that distinction would be manifested in the following manner: If I rub my arm with my hand their extremity (place of contact) is one. Thus they are contiguous. They do not, however, move simultaneously nor do they come to rest simultaneously since at the same time that my hand is moving my arm remains at rest. According to the definition of continuity (B), while the two bodies are contiguous they are not continuous since they do not come to move and to rest simultaneously. Hence, texts (A) and (B) that Belavel provides to support his claim are insufficient in themselves.

There is an important point that Belavel has failed to observe. In Cartesian physics motion is the principle of separation.¹⁹ In the Principles movement is defined as

le transport d'une partie de la matiere, ou d'un corps, du voisinage de ceux qu'il touche immédiatement, et que nous considerons comme en repos, dans le voisinage de quelques autres.²⁰

Following that definition Descartes clarifies his meaning of the above:

J'ai aussi adjoute que le transport de corps se fait du voisinage de ceux qu'il touche dans le voisinage de quelques autres, & non pas d'un lieu en un autre, pource que le lieu peut etre pris en plusieurs facons qui dependent de notre pensee, comme il a ete remarque cy-dessus. Mais quand nous prenons le mouvement pour le transport d'un corps qui quitte le voisinage de ceux qu'il touche, il est certain que nous ne saurions attribuer a un meme mobile plus d'un mouvement, a cause qu'il n'y a qu'une certain quantite de corps qui le puissent toucher en meme temps.²¹

The above text has been amended. In the original Latin "ceux qu'il touche" is written as "contiguorum."²² The

correction has been made to conform to the definition given of movement (Prin. II, 25) that uses the phrase, "touchent mutuellement," which in the Latin is written as "immediate contingunt."²³ Since Descartes is defining movement in both places, movement can be properly defined as the transportation of one part of matter from the vicinity of those which are contiguous to it. Because movement is the separation of one part of matter from another part of matter contiguous to it, then contiguity cannot be identical to continuity since the latter is defined in terms of two bodies which "sont jointes d'une maniere tellement qu'ils entrent simultanement en mouvement ou en repos". Whereas in the case of contiguous bodies, the bodies can separate, in the case of continuous bodies, they move or rest as one.

However, the case cannot be dismissed entirely. From another perspective contiguity implies continuity. There is only one movement proper to an individual body since it can move away, that is, separate, from a certain number of contiguous bodies. Nevertheless, it can participate in innumerable movements since all of the bodies are moving at the same time.²⁴ Insofar as a body does participate in other movements, there may be a basis for the position that, for Descartes, the contiguous is continuous. The case might be argued in the following manner: Because, on the one hand, there cannot be any other body between the two,²⁵ then no action can be exercised on either where their surfaces meet;

and since, on the other hand, the universe is a plenum²⁶ and the whole system is displaced together at the same time,²⁷ the bodies have action exerted on their other sides so that, through the effects exercised on them by surrounding bodies, they move and come to rest as a unity.

While it may be intuitively correct that what is contiguous is continuous, no textual evidence has been offered by Belavel to justify this claim. It has not been shown that Descartes himself believed that the discontiguous is discontinuous. Since this is the premise upon which Belavel's claim that time is discontinuous is made, the validity of that claim is periled.

However, let us grant that Belavel is correct in his premise. Is it legitimate to transfer what is valid in terms of spatial contiguity to temporal contiguity? Three considerations provoke this question. The first is that extension is an essential attribute of material substances and does not apply to thinking substances. Time, however, does. It is a measure of the duration of substances, and it is a mode of thought about all substance insofar as these substances endure. Hence, time applies not only to the extended substance but also to the indivisible thinking substance. Secondly, if we accept that what is spatially contiguous is spatially continuous, contiguity is essentially a spatial property (place) relative to other bodies. Since 'place' can undergo perpetual change in any direction, there

is nothing parallel to 'place' in time. For the parts of time have a necessary order of 'before' and 'after'. Unlike 'place', that order cannot be juxtaposed. Thirdly, in the case of spatial extension the parts exist simultaneously. This is not the case with the moments of time. Since time is constituted by a successive order of moments, no one moment can exist simultaneously with another.

No doubt Descartes' theory of time seems paradoxical. On the one hand, the moments of time can be separated and are independent of one another; no one moment is necessarily connected with any other moment. On the other hand, time is experienced as a continuum of moments each of which is necessarily connected with the other. However, the problem of the discontinuity or continuity cannot be resolved by appealing to dispersed quotations. It must be referred to the whole Cartesian conception of movement as well as Descartes' metaphysics of the thinking substance. This will be done in the remaining chapters. Our immediate concern here is to address ourselves to another kind of criticism that arises from Descartes' doctrine of continuous creation.

C. Indivisibility - Divisibility

In addition to the question regarding the kind of unity that exists between the moments that form a given continuity there is the question of the nature of the moment itself.

Those who presume that time is discontinuous also presume that time is constituted by absolutely indivisible

instants that have no measurable duration. If this is so, then Descartes has a paradoxical view of time and Gueroult is correct when he alleges that the difficulty of Cartesian time is that he draws duration from instants that deny it.²⁸ What needs to be proven to sustain Gueroult's objection is to demonstrate that, for Descartes, the instant is absolutely indivisible.

However, even prior to determining this there is the initial question regarding the assumption that the 'moment' and 'instant' are identical. The texts on continuous creation found in the Meditations and Responses refer to the temporal unit only as a 'moment'. Nowhere in these texts do we find the unit referred to as the 'instant'. There is, however, evidence for interchanging the terms.

In the Discourse, where Descartes speaks about the action of the light, we see that the light reaches the earth in an 'instant':

Et ici m'entendant sur le sujet de la lumiere, j'expliquai bien au long quelle etoit celle qui se devoit trouver dans le Soleil & les Etoiles, & comment de la elle traversoit en un instant les immenses espaces des planetes & des Cometes vers la Terre.²⁹

The same action of the light is discussed in the Principles. In that text we note that the light reaches the earth in a 'moment':

Mais d'autant que le cercle de la matiere qui se meut ainsi ensemble, est plus grand, d'autant le mouvement de chacune de ses parties est plus libre, a cause qu'il se fait suivant une ligne moins courbee, ou moins different de la droite: ce qui peut servir pour empecher

qu'on trouve estrange, que souvent le mouvement des plus petits corps etende son action jusques aux plus grandes distances; & ainsi, que la lumiere du Soleil & des Etoiles le plus eloignees passe en un moment jusques a la terre.³⁰

On the basis of these two texts it seems that, for Descartes, the 'instant' and 'moment' are interchangeable.³¹ In neglecting to provide these texts the critics assume a premise that should have been argued for.

To return to the criticism itself. Ferdinand Alquie states it in this manner:

Il (temps) est fait d'une suite d'instants dont chacune est une sorte de neant de duree. Il n'a aucune force, n'aucune realite propre. Il ne recele en lui aucune principe de continuite.³²

The following text is offered to support this:

Mais, parmi ces natures simples, il convient aussi de compter leurs privations et negations, en tant que nous les comprenons; car la connaissance par laquelle j'ai l'intuition de ce qu'est le neant, l'instant ou le repos, est non moins vraie que celle qui me fait comprendre ce qu'est l'existence, la duree ou le mouvement.³³

As the text indicates, the instant is understood as the privation of duration. In which case it may be said that the instant is durationless. The problem becomes apparent. Either the instant is a duration and can be divided into parts or, if it has no duration as the text suggests, then it cannot be a part of continuous time and becomes a relation between points which are without duration. Since duration is extended and divisible into parts,³⁴ it would seem to follow that each of the parts themselves would have to be divisible units of duration. If the instant is

without duration then it is indivisible; if it is indivisible, how can an assemblage of these form a continuous whole that is divisible into parts? That contradiction was already anticipated by Aristotle, who maintained that indivisibles cannot be arranged so as to compose a continuous whole.³⁵

Are the instants per se indivisible? The isolated text from the Rules is not sufficient to categorically say that the instant is indivisible for Descartes. In justifying his claim that the instant is absolutely indivisible, Gueroult appeals to Descartes' theory of light. According to Gueroult, if the instant was not absolutely indivisible, the light would traverse a distance. This would result in a temporal movement and real speed. Descartes' theory of light rejects just this. Moreover, Gueroult claims, that if light was not instantaneous the entire structure of Descartes' physics would be shaken.³⁶

Norman Kemp Smith proposes another perspective of Descartes' theory of the instant.

Descartes had no option considering that he viewed all changes (qua causal) as instantaneous (effects not temporally sequent to causes) than to adopt a view of time that consists of atoms, non-durational instants independent of every other.³⁷

If Smith means by atomic that they are indivisible, then in what sense are they so? Certainly, for Descartes, the atom is inconceivable in relation to bodies since matter is infinitely divisible.³⁸ That divisibility, however, must

be qualified. What is conceptually infinitely divisible by virtue of the definition is distinct from what is physically infinitely divisible. While Descartes espouses the conceptual infinite divisibility of matter since the nature of matter is extension, he denies the physical infinite divisibility of matter.³⁹ Regardless of the fact that matter is potentially infinitely divisible, it remains true that no finite substance is empowered to actually divide it to infinity. Yet, if we grant that what is inconceivable in relation to spatial entities is not inconceivable in relation to time, then in what sense is the instant indivisible? Since divisibility is qualified in terms of conceptual and physical, is not indivisibility qualified?

We do not know if Smith means that the instants are atomic in the sense that they are conceptually indivisible, and therefore a fortiori physically indivisible, or that they are physically indivisible because we lack the means to divide it. Not everyone would agree with Smith's claim that the atom necessarily implies non-duration. Diodorus, a contemporary of Aristotle, believed that the atom, unlike the geometrical point, is a partless unit that has a positive size. He conceived that temporal atoms were not indivisible in the sense that they have no duration, but that they were indivisible as partless units. The present, as an atomic unit, cannot be divided into a before and after; it is a partless minimum in contrast to a longer

period, the least perceptible time.⁴⁰

What this suggests is that the concept of the instant is susceptible to interpretation. Even if Smith rightly conceives the instant to be an atom and implies by this that it is indivisible, the question still remains: In what sense is it indivisible? Is it indivisible in the absolute sense such that it is both conceptually and physically indivisible? Or is it indivisible only in the physical sense? If it is absolutely indivisible in the first sense then it means that it has no duration. If it is indivisible in the second sense then it means that it is not durationless.

According to Jean LaPorte, the instant is indivisible in this second sense, but the instant is not indivisible in the absolute sense that it has no duration. It is divided from the 'before' and 'after' but in itself it is the shortest segment that can be known.⁴¹ LaPorte offers the following text to support his thesis:

[C]ar encore qu'il arrive quelquefois qu'elles se trouvent disposees en meme sorte que celles qui sont representees en cette figure, elles ne s'y arrestent neanmoins que ce peu de temps qu'on nomme un instant.⁴²

Again from the Principles LaPorte cites another text which indicates that the instant must contain some duration since it measures an action that is extremely prompt. Since speed is measured by time the quantity of the instant is proportionate to the quantity of the speed. This seems to

be what LaPorte is drawing from this text which says that

la matiere de premier element qui remplira incontinent tout l'espace qui sera entre-deux, y aura aussi assez de force pour en separer encore quelques autres; & pour ce que sa force s'augmentera d'autant plus qu'elle en aura ainsi separe davantage de la superficie de cette tache, & que son action est extremement prompte, elle separera presque en un instant toute la superficie de cette tache de celle du Ciel.⁴³

If LaPorte is correct in his analysis, then the instant can be conceived as a present with a depth. While its duration cannot be measured, nevertheless, it does have an enduring quality. That which is physically indivisible is not necessarily conceptually indivisible. Similarly, what is physically immeasurable is not necessarily conceptually immeasurable. It does not follow that because something cannot be measured by finite means, it is absolutely immeasurable. Measurability is conditional since what is measurable can only be actually measured if there is a measurer empowered to measure. If the senses and understanding in their finite constitution are unable to grasp the minuteness beyond a certain point then that thing may be said to be physically immeasurable.

We conceive that there are an indefinite number of snowflakes that fall in any given moment. Yet this is contradicted in the order of experience where we are able to count a definite and limited number. While the order of experience may provide a mode of verification sufficient for a workable hypothesis, it cannot serve as the absolute

ground for certitude. If we translate this in terms of the instant it may be that it cannot be measured because of its extreme minuteness. Does it follow that the instant is without duration and is absolutely indivisible, like a geometric point? Could it not be the case, as LaPorte suggests, that while the instant cannot be physically divided into 'before' and 'after' it is not absolutely indivisible in the way that a geometric point is. It is a partless unit that has some duration notwithstanding the fact that we cannot measure it.

Consider the typist who is rapidly hitting the keys with such speed that we fail to note the individual striking of the keys but only note the variation in patterns of the sounds. There is a similar case in the perception of a musical composition where we only perceive chords or pieces of melodies and not the individual notes because of the rapidity of the playing. In both examples the instant is conceived as the unperceivable infinitesimal unit of time. Insofar as we cannot measure the instant, it is physically immeasurable, but certainly it is not durationless. Nor can we say that absolutely it cannot be divided.

The issue, it seems, is not whether, for Descartes, the instant is indivisible, but rather in what sense it is indivisible. Is it absolutely indivisible like the geometric point, as some critics attest it to be, or is it indivisible in the sense that it is a partless unit?

Certainly it is important to determine that answer since it determines whether or not Descartes' theory of time is paradoxical. If the instant is absolutely indivisible in the first sense then there is a paradox: duration as a divisible quantity is constituted by a succession of indivisible durationless instants. If, however, the instant is indivisible only in the sense that it is a partless unit, then there is no contradiction in Descartes' theory. However, aside from that point there is the fundamental importance of grasping a true understanding of the Cartesian theory of time as an integral part of a total philosophical system. The truth of this will become apparent when we see how that theory conditions his physics and his metaphysics of the thinking substance in terms of its epistemological ramifications.

D. Metaphysical Resolution

Let us return to our original point of inquiry. Descartes' doctrine of continuous creation initiates objections reflecting the paradoxical nature of his theory of time and duration. We have seen that doctrine to be the source of the question regarding the disparity between discontinuity and continuity. While the doctrine is itself the source of the problem it is seen by some critics to provide a metaphysical solution.⁴⁴ Negatively, the discontinuous duration of the substance is the absence of power to exist on one's own. Positively that duration is

the presence of God's creative action that provides a simulacrum continuity. Through that action discontinuity is resolved into an indissoluble continuity. While the moments appear to be naturally united, the unity and continuity that is experienced is essentially a continuous repetition of creations whereby the existence of the substance is renewed in each moment. It is that perpetual repetition which goes unnoticed that generates a unity between the moments so that they appear to form a true continuity. This seems to be what is implied in terms of a metaphysical resolution.

Norman Kemp Smith succinctly assesses the paradoxical question and its metaphysical resolution when he says:

Endurance is not proper to the creaturely as such, this must mean that God, in creatively upholding it, is by His continuous action, at every instant creating the new additional time. It is God's active ever present agency which is alone continuous & abiding; and insofar as the creaturely seems to be, what yet it is not, self maintaining continuously enduring, it is so solely because of its mirroring, or rather seeming to mirror, characters which in their proper nature belong exclusively to its Creative Source.⁴⁵

The radical finitude of the substance to which Smith alerts us is certainly one that is implied when Descartes says that, if for one single moment God withdrew his creative power, "toutes chose qu'il a crees retournaiient au neant pour cette raison qu'elles n'etaient qu'un neant avant qu'elles fussent crees."⁴⁶ We know that in any one moment the substance could cease to exist. We do not know if these moments are discontinuous. Moreover, we know that

God's essence is indivisible, simple, absolute unity and so is His action, "l'idee que nous avons de Dieu nous apprend qu'il n'y en lui qu'une seule action, toute simple et toute pure."⁴⁷ From the side of God, the continuous action by which God conserves the substance is fundamentally one, simple, eternal act and, as such, falls outside the temporal series that is proper to created substances whose duration is essentially successive. From the side of the creature it is the ever-present influence which alone can account for the continuous duration of the substance who lacks a principle of autocontinuation.

A question remains: Is any kind of metaphysical resolution needed? It is, we suppose, if the moments are actually discontinuous. This, however, has not been proven by any critic. The texts on continuous creation themselves never establish the discontinuity of the moments. Nor do they even establish the assumption of the argument - that the moments are actually separate and divided one from the other and are therefore discontinuous. What the texts do establish is the following: The time of my life can be divided into an infinite number of parts and these parts can be separated one from the other. As a proof for the existence of God, it seems that Descartes' point in proposing continuous creation is not that the moments of time are discontinuous, but that the continuity of the duration of finite substances, deprived of a principle of auto-

continuation, can only be explained by a transcendental cause.

Duration is analogous to extension. And like extension it is conceived as an unbroken whole that is potentially divisible into parts.⁴⁸ Considering that analogy, it is questionable whether or not Descartes meant that the moments are actually separate and independent. The texts on continuous creation do not establish that they are. Hence, the appeal to a metaphysical resolution would seem to be unnecessary.

Even if the critics were correct in their assumption that the moments are discontinuous and continuous creation provides a metaphysical resolution to the discontinuity/continuity question, it does not seem to resolve the other question: How can Descartes draw duration from instants that have no duration? The question, however, is only valid if it is true that the instant is absolutely indivisible. This fact has not been proved. Hence, it has not been proved that Descartes' theory of time is paradoxical. On the contrary, there is evidence beyond that presented which establishes that Descartes has a coherent theory of time. The truth is that Descartes has a dual perspective of time that is accommodated to his metaphysical dualism. Let us turn to consider time and its role in the Cartesian physics.

NOTES - CHAPTER II

¹III Med. A.T. IX, p. 39. Haldane's translation is not used here because he translates "le temps" as "the course," which is not accurate. Also, he translates "ce moment" as "this instant". My translation is as follows: "For all the time of my life can be divided into an infinite number of parts, none of which is in any way dependent on the other; and thus from the fact that I was in existence a short time ago it does not follow that I must be in existence now, unless some cause at this moment, so to speak, produces me anew, that is to say, conserves me. It is a matter of fact perfectly clear and evident to those who consider with attention the nature of time that a substance, in order to be conserved in all the moments that it endures, has need of the same power and the same action as would be necessary to produce and create it anew, supposing it did not yet exist, so that the light of nature shows us clearly that the distinction between creation and conservation is solely a distinction of the reason"; c.f. Resp. A.T. IX, p. 127.

²I Resp. A.T. IX, pp. 86-87. Haldane's translation is not used here because he translates "cree continuellement" as "recreate," which is not what the text says. My translation is as follows: "For, even though I had existed from all eternity and hence nothing had preceded my existence, nonetheless, because I see that the parts of time can be separated one from the other, and that therefore I need not conclude that, due to my now existing, I shall in the future do so (unless some cause were, so to speak, to create me anew in each moment). I would not hesitate to call that cause which continually creates me, that is to say, conserves me, an efficient"; c.f. Prin. I, IX, p. 34.

³Martial Gueroult, Descartes selon l'ordre des raisons (Paris 1953), p. 272; Yvon Belaval, Leibniz critique de Descartes (Paris 1960), pp. 229-230; Henri Bergson, L'evolution creatrice (Paris 1907), pp. 374-375; Norman Kemp Smith, Studies in the Cartesian Philosophy (New York 1962), p. 131; Jean Vigier, "Les idees de temps, de duree et d'eternite chez Descartes," Revue philosophique 89 (1920), p. 322; J. Wahl, Du role de l'idee de l'instant dans la philosophie de Descartes (Paris 1920), p. 18; Ferdinand Alquie, L'homme et l'oeuvre (Paris 1956), p. 154; more recently, Mikio Kamiya, La theorie cartesienne du temps (Tokyo 1982), pp. 121-122; rejecting this standard interpretation are, most notably, Jean LaPorte, Le rationalisme de

Descartes (Paris 1950), pp. 158-160; Jean-Marie Beyssade, La philosophie premiere de Descartes (Paris 1979), pp. 129-142; 346-350.

⁴M. Gueroult, "Having demonstrated that God is necessarily the author of my being, in virtue of continuous creation, having proved continuous creation by the absolute independence of the diverse parts of the time of my life, Descartes appears to sustain the thesis of the discontinuity of time," p. 272.

⁵Prin. I, 55, A.T. IX, p. 49.

⁶Ent. avec Burman, Pleiade, p. 1358.

⁷M. Gueroult, p. 272.

⁸Ibid., p. 273.

⁹A Morin, 13, July, 1638, A.T. II, p. 209. The failure to distinguish between separation and separability was noted by LaPorte (p. 158) and later by J. Beyssade (p. 17). Most recently, that same error was noted by Richard T.W. Arthur, "Continuous Creation, Continuous Time: A Refutation of the Alleged Discontinuity of Cartesian Time," Journal of the History of Philosophy (July 1988), p. 354.

¹⁰Y. Belavel, pp. 213, 230.

¹¹Ibid., pp. 217, 218.

¹²VI Resp. A.T. IX, p. 234; H.R. II, p. 249. "Yet, I never denied that it was the extremity of a body; nay, on the contrary, I said that it could with the greatest propriety be called the extremity of the contained body as much as of the containing body, in the sense in which one says that bodies are contiguous when their extremities are together. For certainly, when two bodies touch each other the extremity of each is one and the same, and neither is a part of the other, but both enjoy the same mode."

¹³Ent. avec Burman, Pleiade, p. 1381. Cottingham, p. 30. "It is of little importance how others define continuity and contiguity; for me, I call two bodies continuous when their surfaces are joined so immediately that when they move it is in a single motion, and they both stop moving together. Those which act otherwise are contiguous."

¹⁴A Mersenne, 23, July, 1641, A.T. III, p. 387. "As for the surface which I have said is not a part of the bread nor of the air around it, it is nothing different from the "place" of the Aristotelian schoolmen, nor from the surface of the Geometers, except in the imagination of those who do not conceive it as they ought, and who suppose that the surface of the surrounded body is a part of the circumjacent bodies."

¹⁵Y. Belavel, pp. 218, 230.

¹⁶Aristotle, Physics, V. 3, 227a9, The Basic Works of Aristotle, ed. Richard McKeon (New York 1968), p. 307.

¹⁷Ibid., 227a10-15, p. 307.

¹⁸Ibid., 227a20-23, p. 307.

¹⁹Prin. II, 18, A.T. IX, pp. 72-73; Prin. II, 23, A.T. IX, p. 75; Prin. II, 29, A.T. IX, pp. 78-79; Prin. II, 30, A.T. IX, p. 79; Prin. III, 111, A.T. IX, p. 167.

²⁰Prin. II, 25, A.T. IX, p. 25. "...the transference of one part of matter or of one body, from the vicinity of those bodies immediately touching it and considered as at rest, into the vicinity of some others."

²¹Prin. II, 28, A.T. IX, p. 78. "I have also added that the transference is effected from the vicinity of those bodies that it touches into the vicinity of others, and not from one place to another; because, as has been explained above, 'place' can be understood in several ways, depending on our conception. However, when we take movement to be the transference of a body from the vicinity of those contiguous to it, we cannot attribute to that moving body more than one movement at any given time, because at any given time, only a certain number of bodies can touch it at the same time."

²²Prin. II, 28, A.T. VIII, p. 55.

²³Prin. II, 25, A.T. VIII, p. 53; cf. Prin. II, 29, A.T. VIII, p. 55, where Descartes also uses the term "contiguorum" for the French translation that reads "touchent immediatement" (A.T. IX, p. 79).

²⁴Prin. II, 31, A.T. IX, p. 80.

²⁵Prin. II, 18, A.T. IX, p. 73.

²⁶Prin. II, 16, A.T. IX, p. 61; Prin. II, 13, A.T. IX, p. 69.

²⁷Prin. III, 26, A.T. IX, p. 113.

²⁸M. Gueroult, p. 274.

²⁹Disc. A.T. VI, p. 43; H.R. I, p. 108. "And enlarging on the subject of light, I here explained at length the nature of the light which would be found in the sun and stars, and how from these it crossed in an instant the immense space of the heavens, and how it was reflected from the planets and comets to the earth."

³⁰Prin. II, 79, A.T. IX, p. 147. "But inasmuch as the circle of matter which moves as one, is greater, and inasmuch as the movement of each of its parts is freer, because it follows a line that is less curved or little different from the straight, one should not find it strange that often the movement of the smallest bodies extends its action to the greatest distances; and thus, the light of the Sun and the most distant Stars reaches the earth in a moment."

³¹Beyssade (p. 348) maintains that Descartes makes a distinction between the moment and instant, the former is a part of time whereas Descartes always uses the word "instant" in the strict sense of limit, and not a part of time. Our analysis in this study will show that Beyssade's claim cannot be sustained. Arthur (p. 351) assumes the same position as Beyssade, noting that the instant is indivisible but time is not made up of these. Cf. Harry Frankfurt, "Creation continuee, inertie ontologique et discontinuite temporelle," Revue de metaphysique et de morale (December 1987), p. 462. Frankfurt's article offers a rejection of Gueroult's interpretation that time is discontinuous, but he agrees with Gueroult that the instant is indivisible and without duration. However, Frankfurt, like Beyssade and Arthur, maintains that the instant is not a part of time.

³²F. Alquie, p. 53. "Time is made up of a series of instants each of which is a kind of nothingness of duration. There is no force, no intrinsic reality. It possesses in itself no principle of continuity."

³³Regle XII, Pleiade, 82. H.R. translation is not used because it translates "la duree" as "lapse of time." This is not what Descartes says. My translation is as follows: "But among these simple natures we must rank the privative and negative terms corresponding to them insofar as our intelligence grasps them. For it is quite as genuinely an act of knowledge by which I am intuitively aware of what nothing is, or an instant, or rest, as that by which I know what existence is, or duration, or motion."

³⁴Ent. avec Burman, Pleiade, p. 1358.

³⁵Aristotle, Physics, VI, 1, 231a21-b18, p. 316.

³⁶M. Gueroult, p. 273. An analysis of the Cartesian theory of the instantaneous transmission of light will show that Gueroult is too simplistic in his understanding of the theory and it will be shown in Chapter III that the texts he presents do not provide sufficient evidence to justify his claim.

³⁷N. Smith, p. 111.

³⁸Prin. II, 20, A.T. IX, p. 74. A spatial atom is inconceivable for Descartes primarily because such a concept as the atom would presume that there existed something which God could not divide, and He cannot be deprived of his ability to divide, since this would be a diminishment of His own power. The same would be true, it seems, in the case of time atoms. Given Descartes' rejection of spatial atoms, it would be highly unlikely that he would countenance temporal atoms as absolutely indivisible parts of time.

³⁹Prin. IV, 202, A.T. IX, p. 320; III Med. A.T. IX, p. 37; Prin. II, 35, A.T. IX, p. 83; A More, 15, April, 1649, A.M. VIII, p. 208; Traite de Lumiere, A.T. XI, 12; Prin. II, 20, A.T. IX, p. 7r.

⁴⁰David Sedley, "Diodorus Cronus and Hellenistic philosophy," Proceedings of the Cambridge Philological Society 203 (n.s. 23), 1977, pp. 74-120.

⁴¹Jean LaPorte, Le rationalisme de Descartes (Paris 1950), p. 159.

⁴²Prin. III, 63, A.T. IX, p. 135. "...for, although it sometimes happens that they are arranged like those shown in

this figure, they however only remain in this position for that little space of time we call an instant."

⁴³Prin. III, 111, A.T. IX, p. 167. "...the matter of the first element will immediately fill all the intermediate space, and will have enough force to separate the other nearby globules from that surface. And because the force will increase in proportion to the increase in the number of globules separated from the surface of the spot; its action is extremely prompt, it will spread over the whole surface of this spot of the heaven in an instant."

⁴⁴J. Wahl, p. 18; Jean Vigier, "Les Idees de Temps, de Duree and Eternite chez Descartes," Revue philosophique de la France et de l'etranger 89 (1920), p. 225; Roger Lefevre, Le criticisme de Descartes (Paris 1958), pp. 43-54; M. Gueroult, p. 275; N. Smith, p. 202.

⁴⁵N. Smith, p. 202.

⁴⁶A Hyperaspistes, August, 1641, Pleiade, p. 1134. "...All things that he had created would return to nothing for the reason that they were nothing before they were created."

⁴⁷A Mesland, 2, May, 1644, A.T. IV, p. 119; Kenny, p. 151. "...for the idea which we have God teaches us that there is in him only a single activity, entirely simple and entirely pure." Cf. A Mersenne, 27, May, 1630, A.T. I, p. 153.

⁴⁸Ent. avec Burman, Pleiade, p. 1358.

CHAPTER III

TIME - THE NUMBER OF MOVEMENT

A. Movement - Pre-Principles

"Thoroughgoing geometrization--the cardinal sin of Cartesian thought leads to the intemporal: space is retained but time is eliminated."¹ Does Descartes' theory of movement imply the denial of time, as A. Koyre and others attest?² Time is the number of movement, it is the way in which we think about that duration.³ If time is eliminated it is because Descartes' concept of movement excludes time. An examination of that concept will determine if, and in what sense, time is eliminated.

What Descartes has to say about movement prior to 1640, when he was writing the Principles, should be considered separately. There are two reasons for this. The first is that in Descartes' early writings he espouses the existence of a vacuum. Hence, we find him explaining the movement of falling bodies in terms of the force of gravity. After 1631, however, Descartes no longer believed that there was such a thing as a vacuum and he abandoned his theory on the movement of falling bodies.⁴ Secondly, before 1640, weight was an objective reality in bodies. After that, Descartes regarded it as a sensible and subjective quality.⁵

Descartes could no longer define a body by its weight nor consider weight a factor in movement. These shifts in Descartes' thinking account for the disparity between Descartes' earlier notion of movement and his later one. Let us briefly consider Descartes' thoughts on movement before 1640.

Commenting on the early writings of Descartes, J. Vigier makes the observation that, for Descartes, the law of inertia dominates the material world. That law proposes the constancy of speed, and time loses all importance. An invariable speed is one detached from time, since it is the product of the mass and distance covered; but all other speeds increase or decrease with time.⁶ Vigier's assessment deserves consideration.

Descartes provides us with an example of how the concept of speed is to be understood. In 1629, still believing in the existence of a vacuum and the reality of weight, Descartes gives an explanation of how a body falls. Descartes provides a geometrical description in which he traces the fall of a body as if it were moving along a vertical spatial trajectory:

Dans laquelle vous me demandez pourquoi je dis que la vitesse est imprimee par la pesanteur, au premiere moment comme un, au second moment comme deux, etc.... Permettez-moi de vous repondre que je ne l'ai pas entendu ainsi; mais la vitesse est imprimee par la pesanteur au premier moment comme un, et au second moment par le meme pesanteur common un encore, etc. Or, un au premier moment et un au second font deux, et avec un au trois, et la vitesse est augmente ainsi

en proportion arithmetique...D'ou il suit certainement que, si vous laissez tomber une boule en spatio plane vacuo de 50 pieds de haut, de quelque matiere qu'elle peut etre, elle emploierait toujours justement trois fois autant de temps aux 25 premieres pieds qu'elle ferait aux 25 derniers.⁷

In the first moment the body receives an impetus that produces a motion of a definite speed, that is, the elementary speed. In the second moment the body receives a new impetus that produces a motion with a speed equal to the elementary speed of the first moment. This new elementary speed of the second moment is added to the elementary speed produced in the first moment so that the actual quantity of speed in the second moment is double that of the first. Thus, in each moment after the first moment the speed is double, then triple, then quadruple, etc. The addition of constant speeds means that in each moment the increase in speed will always be arithmetically proportional. What we find is that the variability of the quantity of speed found in each moment, that is, the increase of speed, is constituted by a sum of invariable elementary speeds. The uniformity and variability can be numerically expressed. (The lower case letter represents the new unit of elementary constant speed.) Starting with the first moment we can see how the increase in speed in each moment thereafter is arithmetically proportional: $1 + 2(1 + 1^a) + 3(1 + 1^a + 1^b) + 4(1 + 1^a + 1^b + 1^c)$, etc. Because the elementary speed of each moment is invariable, it is possible to project, as Descartes does,

that the time needed to cover the last 25 feet will be three times less than the time needed to cover the first 25 feet.

It is evident, however, that speed is the product of the force of gravity and distance traveled rather than the time elapsed. A stone, for example, which is attracted to the earth in a vacuum, receives a unit of speed and covers a single space. In the second moment it receives an additional unit and covers a double space, and in the third moment it covers three times the space covered in the first moment, etc. The primary question for Descartes is not how fast the body falls but how far. Only secondarily does Descartes consider the fact that it will take less time to travel the last distances than it did the first.

Can we say that time is eliminated from Descartes' concept of movement? It seems so if we consider that time is only an extrinsic factor--one which is simply another way of describing the speed. Insofar as Descartes proposes the invariability of speed, time is not an intrinsic factor in the measuring of speed. Time is merely an extrinsic factor in the measuring of speed and acceleration since the latter is simply the arithmetically doubling, tripling, etc. of the invariable speed-movements. With the invariability of speed, Descartes can eliminate time as an intrinsic factor in his consideration of speed since arithmetic takes the place of time.

However, if Descartes deserves to be criticized for his belief in the invariability of elementary speed, it is not because he detaches it from time. The invariability of speed points to Descartes' mistakenly believing that the force which moves the stone remains constant. So long as the force remains constant it will produce a constant speed since the speed is proportionate to the force. Descartes soon discovered that such a law is contrary to nature. All natural powers act to a greater or lesser degree depending on the manner in which their subject is disposed to receive their action. Hence, Descartes realized that a stone's disposition to receive a new motion, or an increase in speed, is not always the same. A stone moving very fast would be more resistant to a new motion than if it were moving very slowly.⁸ So long as Descartes maintained a belief in the constancy of force the invariability of speed was destined to be a by-product. Since speed was invariable, Descartes could dispense with giving primary consideration to the question of how much time it takes for the body to fall. One could obviously see that, since the speed increases in arithmetical proportion, the time would be proportionate. As the speeds increase, the time necessary to cover the same distance would decrease.

Let us pursue the claim that time is eliminated from Descartes' concept of movement. After 1631 Descartes no longer believed in the existence of a vacuum and he

abandoned his concept of the force of gravity.⁹ The problem of falling bodies ceased to be a concern to Descartes. He then turned to the problem of forces in equilibrium. Unlike Galileo, who considered speed a factor in explaining forces in equilibrium, Descartes chose to ignore speed. Descartes considered only the factors of distance and weight:

La premiere chose dont on peut en ceci etre preoccupe, est que plusieurs ont coustume de confondre la consideration de l'espace avec celle de temps ou de la vitesse....Que si j'avois voulee joindre la consideration de la vitesse avec cette de l'espace, il m'eut etre necessaire d'attribuer trois dimensions a la force, au lieu que je lui en ai attribue seulement deux, afin de l'exclure.¹⁰

From the above text there seems to be every indication that Descartes is eliminating speed from his concept of movement.

What is behind this strategy? Underlying Descartes' disavowal of speed and time is his rejection of any concept of movement that could be explained in terms of an intrinsic principle of action. Such a concept presumably would posit an occult quality which would elude calculation. This seems to be one of the points that Descartes is making in his letter to Mersenne:

Ce vous dites que la vitesse d'un coup marteau surprend la Nature, en sorte qu'elle n'a pas loisir de joindre ses forces pour resister, est entierement contre mon opinion; car elle n'a point de forces a joindre, ne besoin de temps pour cela, mais elle agit en tout mathematique.¹¹

Given the two determinate factors of size and distance, Descartes could project the possibility of mathematically

calculating the movement of bodies. The greater the size of the hammer, the more the air resists it and thus it follows that more force is needed to make it go higher. The rate of motion is then seen to be the product of the mathematical factors of size and distance (extension). Theoretically, that rate could be statistically determined.

It was no doubt Descartes' vision of a mechanical universe that prompted him to exclude the consideration of speed:

Je voudrais etre capable de repondre a ce que nous desirez touchant vos Mechaniques; mais encore que toute ma Physique ne soit autre chose que Mechanique je n'ai jamais envisage particulierement ces questions qui dependent de mesures de la vitesse.¹²

Why does Descartes exclude speed? How is it inconsistent with his mathematical physics? He gives us the answer:

Je vous prie de m'excuser si je ne repons point a votre question touchant le retardement que recoit le mouvement des corps pesans par l'air ou ils se meuvent; car c'est une chose qui depend de tant d'autres, que je n'en saurois faire un bon conte dans une lettre; & je puis seulement direr que ni Galilee ni aucun autre ne peut rien determiner toucher cela qui soit clair & demonstratif, s'il ne fait premierement ce que est que la pesanteur, ¹³ & qu'il n'ait les vrais principes de la physique.

One cannot consider speed for the reason that one cannot perform any experiment accurately enough to determine how the speed could be increased or decreased since these depend on so many factors which elude perception. There was simply no demonstrative solution when one employed the concept of speed. Hence, it was inconsistent with Descartes' mechanical physics.

Prior to the Principles, time, as merely an extrinsic factor in the measurement of speed, plays an insignificant role in the Cartesian physics. Does time ever achieve an important role? New insights prompted Descartes to reassess his ideas of bodies. This gave rise to new ideas and explanations of the movement of bodies and time.

For one thing, Descartes abandoned his belief in the objective reality of weight; it could no longer be a determination in the rate of motion. In the Principles Descartes ranks it among the secondary qualities such as color and hardness. As non-essential properties, they could be taken away from the body while the substance still would remain intact. What is essential to bodies is that they are extended in length, breadth and depth.¹⁴ Since bodies were no longer defined in terms of weight, motion could no longer be understood as the product of weight and distance. As far as the Cartesian physics is concerned, all that can be clearly and distinctly perceived in these bodies is their extension, the division of their parts into different sizes, their figure, situation and local movement, which latter has all degrees of duration.¹⁵ Having arrived at a geometrical concept of bodies, Descartes would have to redefine motion in terms of this definition of body. This definition would alter the role time plays in the Cartesian physics.

B. Local Movement - Circular Movement

After 1640 Descartes proposes a theory of movement in accordance with his definition of bodies. All the matter in the universe is one and the same kind; it is extended and divisible and its parts are movable. Given the geometric nature of matter, Descartes conceived only local movement to be possible. The latter is properly defined as

le transport d'une partie de la matiere, ou d'un corps du voisinage de ceux qui le touchent immédiatement, et que nous considerons comme en repos, dans le voisinage de quelques.¹⁶

Since there is no void, in effect all local movement translates into circular movement. This view that all motion is circular reflects Descartes' belief that our planetary system is a huge vortex at the center of which is the sun. There are smaller vortices, including the earth, which move in the same direction as the larger vortex. Moreover, everything in these vortices follows the same circular path.¹⁷ Descartes spells out very specifically what he means by circular movement:

Après ce qui a été démontré cy-dessus, à sauoir que tous les lieux sont pleins de corps, & que chaque partie de la matiere est tellement proportionnée à la grandeur du lieu qu'elle occupe, qu'il n'est pas possible qu'elle en remplisse un plus grand, ni qu'elle se referre en un moindre, ni qu'aucun autre corps y trouve place pendant qu'elle y est, nous devons conclure qu'il faut necessairement qu'il y ait tous-jours tout un cercle de matiere ou anneau de corps qui se meuvent ensemble en meme temps; en sorte que, quand un corps quitte sa place à quelqu'autre qui le chasse, il entre en celle d'un autre, & cet autre en celle d'un autre, & ainsi de suite jusques au dernier, qui occupe au meme instant le lieu delaisse par le premier.¹⁸

There is no general consensus about Descartes' post-1640 understanding of time in relation to movement. J. Wahl contends that Descartes' definition of movement supposes only the ideas of the instant and of immediate contiguity. Therefore, in order to understand circular movement which is effected instantly, it is necessary to admit a division of time and matter.¹⁹ Gueroult, however, insists that this is not the case. The absolute indivisibility of the instant entails the infinite division of extension rather than the divisibility of extension entailing the division of time.²⁰

It is evident that circular movement implies the divisibility of matter. Since there is no void, and all bodies are moving at the same time, it is necessary that the matter constantly divide itself so that it can be accommodated to the disproportionate spaces left by contiguous parts. It is not so evident, however, that circular movement implies the divisibility of time. Nor is it evident that it does not. We know the circular movement takes place in the instant. The question is one of determining the divisibility or indivisibility of the instant.

The point of departure for our inquiry is to determine if the instants engender real finite speeds. This is warranted because speed is a dimension of motion, and all dimension is measurable in the same way that a line is measurable. What is measurable is also divisible, it can be measured and it can be divided. Since motion is measured

by time, the instant as a part of time would presumably be a measurable quantity falling under the category of magnitude and therefore also divisible. The dynamics of the relationship between speed and the divisibility or indivisibility of the instant will become clearer as we proceed to explore the issue.

In perusing the Principles we see that contrary to Descartes' early thinking he now introduces the factor of speed as a major consideration in his theory of movement. This decided shift in Descartes' view of movement no longer asks the question: How far does a body travel? The quantity of motion ceases to be equal to the weight times the distance. Nor does Descartes propose that bodies are moving at constant speeds. The quantity of motion is now seen to be the product of size (or volume) and speed. We now see that speed is variable.

Car, bien que le mouvement ne soit qu'une facon en la matiere que est meue, elle en a pourtant une certaine quantite...qui n'augmente & ne diminue jamais...encore qu'il y en ait tantot plus & tantot moins en quelques unes de ses parties. C'est pourquoy, lors qu'une partie de la matiere se meut deux fois plus vite qu'une autre, & que cette autre est deux fois plus grande que le premiere, nous devons penser qu'il y a tout autant de mouvement dans la plus petite que dans la plus grande; & que toutefois & quantes que le mouvement d'une partie diminue, celui de quelque autre partie...augmente a proportion.²¹

Given Descartes' law of the conservation of movement, we must conceive that in each instant the same quantity of motion is retained regardless of the fact that some bodies

are of unequal size and move at unequal speeds. The seven rules of impact that follow the general law of the conservation of movement are Descartes' attempt to explain how it might be possible to determine, according to the factors of size and speed, the exact extent of changed or unchanged motion in each body at each instant.²²

The quantity of motion is always the same, the apportioning of that motion, however, is contingent on size and speed. For example, if B was twice as large as C it would transfer one-third of its quantity of motion to C and its speed would be reduced by one-third, so that B would need as much time to travel a distance of two feet as it previously did to travel a distance of three feet.²³ Theoretically, according to these rules of impact, one could explain in terms of size and speeds how bodies would react under ideal conditions. Presumably, one could predict the rate of motion and the direction of a moving body in the next instant by knowing the size and speed of the body moving and those of the body it is contacting in the present instant.

Let us consider what takes place in these instantaneous elementary movements. First of all, the divisibility of matter is necessary for circular movement. According to Descartes, it is not possible for the matter which now fills the space G, for example, to fill successively all the spaces of gradually decreasing sizes between G and E unless

these parts adapt their shape and divide themselves to fit exactly the innumerable dimensions of these spaces.²⁴

Secondly, circular movement implies not merely the divisibility of matter but also variable measurable speeds. It is not enough that the bodies undergo indefinite division. Something more is required. They must move at different speeds. For in the case of an imperfect circle it is the speed of the movements that compensates for the inequalities of the places,

toute la matiere qui est comprise en l'espace EFGH peut se mouvoir circulairement, & sa partie qui est vers E, passer vers G, & celle qui est vers G, passer en meme temps vers E, qu'il faille supposer de condensation ou de vide, pourvue que, comme en suppose l'espace G quatre fois plus grand que l'espace E & deux fois plus grand que les espaces F & H, on suppose aussi que son mouvement est quatre fois plus vite vers E que vers G, & deux fois plus que vers F ou vers H, & qu'en tous les endroits de ce cercle la vitesse du mouvement compense la petitesse du lieu. Car il est aise de connoitre en cette facon qu'en chaque espace de temps qu'on voudra determiner, il passera tout autant de matiere dans ce cercle par un endroit que par l'autre.²⁵

In Descartes' early concept of movement he proposed the invariability of speed and time was not an intrinsic factor in his consideration of movement. However, in the Principles, Descartes now introduces the variability of speed (i.e., acceleration and deceleration) and he re-establishes the importance of time in his consideration of movement. The point in question is how Descartes conceives the instant when he sees it as the unit of time in which the elementary movements take place.

Speed is a dimension of motion and dimension is a quantity. Quantity is either discrete like the indivisible point and countable as arithmetic quantity; or quantity is continuous and analogous to extension and therefore measurable as geometric quantity. While a point is used as an aid by which we construct a numerical assemblage, Descartes makes it clear that if anything can be conceived in terms of 'more' or 'less' it falls under the category of magnitude and is measurable and divisible.²⁶ Insofar as there are rates of speed that can be conceived in terms of fast and slow (that is, more or less speeds), speed falls under the category of continuous quantity that is both measurable and divisible. Time then becomes that measure by which we conceive of the motion of bodies insofar as that motion has some speed. Since there are variations of speed (real finite speeds) in the instant, and these are measurable and divisible, then the instant as a unit of time presumably must have the characteristics of measurability and divisibility. For that which serves as a measure must be homogeneous with the measured; thus we measure spatial magnitudes by spatial magnitudes, that is, by a cubit or a yardstick or some other linear measure.²⁷

It would seem that Descartes conceives the instant to be a measurable and divisible quantity. This is precisely the issue. Several texts provide us with a basis for resolving the issue. In Article 33, Principle II (cf.

ftn. #18), Descartes talks about the elementary movements and notes that the bodies "meuvent ensemble en meme temps," and "occupe au meme instant le lieu delaisse par le premier." In that text, while referring to these instantaneous elementary movements, he also notes that in "chaque espace de temps" the same quantity of matter will move in a circle (cf. ftn. #25). Since all circular movement takes place in the instant, we must assume that he is referring to the instant as that "espace de temps." For Descartes "l'espace" is identical to extension.²⁸ If Descartes conceives the instant as a space of time, as apparently he does, then it is analogous to an extended line and would be both measurable and divisible.

A clearer illustration of this concept of the instant is implied in the following text:

On ne sauroit determiner aucune partie si petite entre tous les points F & D qu'elles ne soit plus grande que celle qui doit sortir a chaque moment hors de la ligne FD a cause que pendant tous les moments de temps que la boule s'approche de B, elle accourcit cette ligne FD et lui fait avoir successivement plus de differentes longueurs qu'on n'en sauroit exprimer par aucun nombre.²⁹

In each moment that the globule moves from F to D the distance is successively shortened. The length of the distance traversed is proportionate to the speed of the moving globule in each instant. Let us suppose that the length of time it takes for the globule to cover the distance from F to D is five minutes. According to what Descartes says, in each of the moments³⁰ the globule is

moving at some speed so that no matter at what rate of speed it is moving some length of space is always being covered. Since some space is covered in each of the moments, the remaining time and distance necessary to reach D is proportionately shortened. This would only be possible if the moments themselves had some length. For we conceive the total time of five minutes as a length of time; time is either long or short as when we say that the journey took a long time. And just as a line is divisible into units that have length, similarly the elementary moments of time are conceived as having some length that is both measurable and divisible. If the elementary moments of time, i.e., the instants, are identical in length, they can serve as the common unit of measurement for the extent of distance traversed. The fifth law of impact demonstrates the point,

ainsi, apres que B rencontre C, il iroit d'un tiers plus lentement qu'auparavant, c'est a dire qu'en autant de temps qu'il auroit parcourir auparavant trois espaces, il n'en pourroit plus parcourir que deux.³¹

The above two passages project both speed and time as dimensional quantities that are extended and divisible into parts. If we are to give any credence to what Descartes says in these texts, it seems evident that the elementary movements have a real finite speed that take place in a brief "espace de temps".

But why do we emphasize the fact that the elementary movements have a real finite speed? Because, it is the only

kind of speed consistent with Descartes' definition of speed as a dimension of motion which is measured by time. We know that speed is a dimension of motion, and that motion can be conceived in terms of fast or slow. Anything that admits of a 'more' or 'less' is a matter of comparison. When we are comparing two things there is no way of determining exactly in what proportion the greater exceeds the lesser unless we treat the quantity as being in some way analogous to extension and place it under the category of magnitude.³² Insofar as we treat the quantity as a magnitude it is measurable. The only way in which we can account for the fact that the movements are conceived to be fast or slow is to assume that they are real speeds that have been measured in some way. While it may be impossible to measure the exact rate of speed, nevertheless, it can be measured in a general way by comparing it with the speeds of other movements. We see this in the case of any given magnitude that we wish to measure. We may not have an exact linear measure as a cubit or yardstick to measure a given spatial magnitude, yet if we compare it with another given magnitude we can determine whether or not it is greater or lesser than the other. The same holds true for speed.

It would be impossible to determine the speed of any movement as being fast or slow unless it was compared with some other movement that had a finite speed. Time is the way in which we measure motion. We measure the rate of the

speed of a car by the time it takes to travel a certain distance. The movement of the car can be measured by time because time itself is a movement. Clock time, that is, the temporal units of minutes and hours, is nothing more than the movements of the hands of a clock; and the temporal units of days and years are determined by the movements of the heavens.³³

When it comes to measuring the speed of the elementary movements it may be true that no exact measure can be determined. This does not preclude any measurement in terms of fast or slow. Since all of matter is undergoing change at the same time, it is possible to compare the speed of the motion of one part of matter with that of another part of matter. It is possible to determine their respective speeds relative to each other as being fast or slow. Even in the case of invariable speeds where each of the elementary speeds remains constant, the fact that one can determine, as Descartes did, that the speed of these remains constant implies that the speed of the latter movement has been compared to the speed of the movement preceding it.

The comparative aspect of speed is even more apparent in the Principles, which manifests Descartes' new thinking on movement. Here Descartes has presented us with a concept of speed as a real finite quantity. We find that movements have relational velocities that are measurable, they are fast or slow, and these movements take place in an "espace

de temps". Descartes clearly endorses a notion of speed as a finite and measurable quantity and an intrinsic factor in his understanding of movement:

Or le mouvement n'estant point une qualite reele, mais seulement on ne peut concevoir qu'il soit autre chose que le changement par lequel un cors s'eloigne de quelques autres, & il n'y a en lui que deux varietez a considerer; l'une, qu'il peut etre plus ou moins vite; & l'autre, qu'il peut etre determine vers divers cotez.³⁴

There is no evidence that Descartes ever countenanced a notion of infinite speed as it relates to movement. Nevertheless, Gueroult has made the categorical claim that the speed must be infinite for the reason that the instant is absolutely indivisible.³⁵ Neither is the case.

Nowhere does Descartes ever talk about speed as infinite. Speed is measured in passing time. The finite cannot be composed of infinities and in Descartes' view infinite speed is a contradictory concept: "Et je puis seulement dire qu'il implique contradiction qu'il y ait une vitesse infinie en la nature."³⁶ We know that speed is a dimension of motion, and all dimension is measurable. If speed was infinite it would not be measurable. Infinite speed, then, is inconsistent with Descartes' definition of speed as a dimension of motion. Moreover, it is inconsistent with Descartes' mathematical physics since it introduces a theoretically incalculable factor in nature. The infinite, by definition, cannot be comprehended by the finite intellect.³⁷ Further, Descartes never believed anything,

except God (whose concept contains infinity)³⁸ to be actually infinite. Even extension can only be called indefinite in the sense that it extends further than any man can conceive.

What we find Descartes saying about speed is that there are degrees of speed ranging from extreme slowness to extreme swiftness. The following three passages attest to the indefinite quantitative aspect of speed. In attempting to explain how bodies strive to move away from the center of their movement, Descartes uses the example of the motion of an ant:

Je ne doute point que le mouvement de cette fourmi ne doive etre tres-lent au commencement, & que son effort ne sauroit sembler bien grand, si on le rapport seulement a cette premiere motion; mais aussi on ne peut pas dire qu'il soit tout a fait nul, & d'autant qu'il augmente a mesure qu'il produit son effet, la vitesse qu'il cause devient en peu de temps assez grande...Au premiere moment qu'on fera mouvoir ce tuyau autour de centre E, cette boule n'avancera que lentement vers Y;³⁹

As Descartes suggests, speed can be so slow that it is almost next to complete rest. One cannot, however, conceive it to be so slow that it would be equal to zero speed.

In contrast to the extreme slowness of the motion of some bodies there is the extreme swiftness of the motion of other bodies,

qu'il n'y a point de vide, il faut necessairement qu'il s'y trouve une telle matiere dont les parties soient si petites & se meuvent si extremement vite, que la force dont elles recontrent les autres cors soit suffisante pour faire qu'elles changent de figure⁴⁰ & s'accomodent a celle des lieux ou elles se trouvent.

The following passage from the Traite clearly establishes Descartes' belief that each instant, including the elementary phase of movement, contains a movement having degrees of speed that can be measured in terms of 'more' or 'less'. Discussing God's causality in regarding the disposition of movements in the universe Descartes writes,

des le premier instant qu'elles (movements) sont crees, les unes commencement a se mouvoir d'un cote, les autres d'un cote, les autres d'un autre; les unes plus vite, les autres plus lentement & qu'elles continuent par apres leur mouvement suivant les loix ordinaires de la Nature.⁴¹

Speed is a dimension of motion, and dimension is the aspect according to which something is measurable. This is not to say that the degree of slowness or the degree of swiftness can physically be measured. As a matter of fact, for Descartes they cannot,

mais nous n'avons pu determiner en meme facon combien sont grandes les parties auxquelles cette matiere est divisee, ni quelle est la vitesse dont elles se meuvent, ni quels cercles elles decrivent. Car ces choses ayant pu etre ordonnees de Dieu en une infinite de diverse facons.⁴²

Speed is a dimension of motion and motion takes place in time. The elementary movements, broken down as they are into instantaneous movements, are measurable in the same way that a length is measurable. Hence, the instant as a part of time, however brief, must be conceived as an "espace de temps", that is, a measurable and divisible quantity. Otherwise, it cannot serve as the condition for speed which is a quantitative dimension and, therefore, is both

measurable and divisible. The fact that the speed cannot actually be physically and exactly measured or divided does not affect the truth that theoretically it could be.

In the Principles Descartes spends considerable effort in describing how movements take place in the universe. In accordance with Descartes' vortex theory all movement is circular. And, as we see, such movements break down into instantaneous elementary movements. While all movement is circular, nevertheless, it tends to rectilinear movement.⁴³ The inclination to rectilinear movement persists, although bodies are not actually moving in a rectilinear path. Descartes provides us with an example of what he means when he says that all circular movement tends to rectilinear movement. If a wheel is turned on its axis it would still have the inclination to go straight. For if it was released from its axis it would in fact do so.⁴⁴ The same thing applies to a stone that is whirled around a string. As soon as it is released it goes straight.⁴⁵ However, while all movement tends to be rectilinear, yet because of the existence of obstacles, i.e., contiguous bodies, its movement is impeded and is forced to be circular.⁴⁶

The inclination to rectilinear movement can be traced to the action of light that is ontologically prior to all local movement. For Descartes, the action of light serves to explain all the movements that constitute the universe. For this reason, Descartes' theory of the transmission of

light is the ultimate point of reference for our understanding of the role time has to play in the Cartesian physics. No analysis of time would be complete without considering that theory.

C. Instantaneous Transmission of Light

There is no question as to the import of Descartes' theory of the transmission of light:

Je vous dirai que je suis maintenant apres a demeler les chaos, pour en faire sortir de la lumiere, que est l'une des plus hautes & des plus difficiles matieres que je puisse jamais entreprendre; car tout physique y est presque comprise.⁴⁷

To give an exhaustive treatment of Descartes' theory of light is beyond the scope of this study. Yet, something must be offered in the way of a general overview if we are to understand the temporal dimensions of that theory.

In the Traite de Lumiere Descartes presents a detailed description of his theory of light. The Principles, however, provide a clearer picture of how that theory is connected with the rest of his physics. Ultimately, the action of light explains the phenomena of movement in the universe. All the matter in the universe is composed of one principal kind of matter that is fine and fluid, and differs in size and shape. The three elements that constitute the visible world all have the properties of light. The first element, the sun and stars, is defined by its luminous character; it sets up the action of light. The second element has interstices that are filled with particles of the first

element through which light is transmitted. The third element, the earth and the other planets, is defined by its opaque character; it reflects the action of the sun.⁴⁸

While the sun and fixed stars do not move from place to place, they are very mobile as they move on their own axis. That movement resembles the movement of fire.⁴⁹ Because the sun is composed of very fine fluid and mobile matter, it carries the surrounding parts of the heavens with it. Each of these heavens moves independently and separately around their own center while they move together in groups around other points so that a vortex system is created. As the sun moves around its own axis, its agitation creates a whirlpool effect so that all of the vortices in the universe are constantly being agitated by the sun at the same time.⁵⁰ It was Descartes' belief that the constant movement of the three elements, that is, their effort to separate and divide, could be traced to the action of light.

In the third part of the Principles Descartes attempts to explain the movements of the first and second elements. Light is that 'effort' by which the small particles of the first and second elements recede from the center around which they revolve.

Je tacherai maintenant d'expliquer le plus exactement que je pourrai, quel est l'effort que sont ainsi, non seulement les petites boules qui composent le second element, mais aussi toute la matiere du premier, pour s'eloigner des centres S, f & semblables, autour desquels elles tournent; car je pretends faire voir cy-apres que c'est en cet effort seul que consiste la

nature de la lumiere & la connoissance de cette verite pourra servir a nous faire entendre beaucoup d'autres choses.⁵¹

Descartes proceeds to move on to the fourth part of the Principles in which he explains the movements of the earth and planets by the 'action' of light:

Quant a la lumiere, qui est la troisieme action que nous avons ici a considerer...je pense avoir des-jacy-dessus assez explique sa nature; il rest seulement a remarquer que...bien que tous ses rayons viennent en meme facon du Soleil, & ne facent autre chose que presser en ligne droite les corps qu'ils rencontrent, ils causent neanmoins divers mouvemens dans les parties du troisieme element, dont la plus haute region de la Terre est composee.⁵²

The action of the light consists in a pressure to centrifugal motion. Since the sun rotates on its own axis the action of the light reaches the earth from all points of the sun's surface. Because the pressure does come from all points it occurs along straight lines which are the sun's rays. The rays are the direction by which the pressure of the sun is emitted as it passes through the transparent medium to the earth.

We are prompted at this point to note that while our discussion of the nature of light will be incomplete because our central concern is not Descartes' physics per se, this does not prevent us from raising some questions regarding Descartes' theory of light. An appropriate question at this time regards the ontological status of light. Descartes certainly suggests that light is ontologically prior to all other matter in the sense that the action of the light serves

as a cause that can account for all the movements in the universe.

The light as a material substance is essentially no different than other substance. Nor is it essentially different from any of the other heavens. It has its own vortex and the sun is the center. Yet, the sun is the principal heaven. It emits a pressure as it continuously turns around its own center with "tres grande vitesse" and presses on all sides of the matter of the sky, and that matter extends without interruption to our eyes.⁵³

However, the light, as a material substance, has no intrinsic power or force by which it can effect any natural action. Yet, Descartes insists the light is an efficient cause,

car si la lumiere, c'est a dire lux, est l'action ou le mouvement dont le soleil pousse la matiere subtile qui l'environne,...il ne suit pas de la qu'il premier que cette action, ny qu'il en soit la cause efficiente.⁵⁴

While Descartes refers to the light as an efficient cause, he does not wish us to consider it as a causa secundum fieri, that is, a cause of coming into being. If it were, the sun would not need to exist once it had produced its effect, as is the case of the father who begets the son. The sun must be understood as a causa secundum esse, a cause that can account for the continuation of the effect.⁵⁵ The sun continues to shine and the parts of matter continue to move. If we conceive of the light as a cause, albeit a causa

secundum esse, it cannot be understood in any way as being a cause by virtue of an intrinsic principle of action. For, it is essentially extended matter.

The movement of the sun as well as all the other movements of the parts of matter can only be accounted for by appealing to a transcendental cause. Without that cause all movements, including that of the light, remain totally unexplainable. There is, and can be, only one cause in the Cartesian universe and that cause is God:

Pour ce qui est de la premiere (la cause) il me semble qu'il est evident qu'il n'y en a point d'autre que Dieu, qui de sa Toute puissance a cree la matiere avec le mouvement & le repos & qui conserve maintenant en l'universe, par son cours ordinaire autant de mouvement & de repos qu'il y en a mis en le creant.⁵⁶

As far as the light is concerned, it must be conceived as a secondary cause, or more accurately, as the condition for movement:

La reponse que vous leur avez donnee, a savoir que, lors que Dieu a dit: fiat Lux, il a fait mouvoir les parties de la Matiere, leur a donne inclination a continuer ce mouvement en lignes droites, est bonne; car cela meme est la Lumiere.⁵⁷

Insofar as God always conserves the sun with its movement, the rest of the universe moves with this sun. Ultimately, God is the absolute cause of all movement.

If one insists on calling the light a 'cause' it remains true that its causality is derivative. In order to avoid any misunderstanding of the 'action' of light, the latter should be called more accurately a 'condition'. While Descartes never refers to the light as a condition, he

suggests that this term is appropriate. He makes the following analogy: The light is prior to all movement as man is prior to his reason. In order for man to use his reason, he must first exist. In order for movement to take place, the sun must first exist.⁵⁸ By appealing to a transcendental cause Descartes is able to explain the ontological priority of light as a cause.

While this metaphysical approach answers the question regarding the ontological status of light, it does not make it easier to understand what Descartes means by his theory of light. This, in part, can be traced to inconsistencies in terminology. We have seen Descartes talk about the light as an 'effort', and as an 'action' "presser en ligne droit". Elsewhere we find Descartes referring to the light as an inclination to movement. "Par la lumiere," he writes, "je n'entendais pas tant le mouvement lui meme, que l'inclination ou le propension au mouvement."⁵⁹ Thus far we have been led to believe that light is some kind of elusive 'force' whose effects are alone experienced. He makes light out to be the tendency towards movement or the condition for movement.

Yet elsewhere, Descartes implies that it is some kind of movement. In the Dioptrics he refers to the light as "un mouvement ou une action qui tend a causer quelque mouvement."⁶⁰ In that same treatise he leads us to believe that light is a movement, noting that "la lumiere...est un

certain mouvement ou une action fort prompte & fort vive, qui passe vers nos yeux, par l'extremite de l'air & des autres corps transparens."⁶¹ If Descartes wishes us to understand light as a kind of movement, it certainly is distinguished from other movements. In the Principles he clearly says that it is not a movement, but a "force" that causes pressure:

La force de la lumiere...ne consiste point en la duree de quelque mouvement, mais seulement en ce que ces petites boules sont pressees...encore qu'elles ne s'y meuvement peut-etre pas actuellement.⁶²

Burman informed Descartes that he found it difficult to understand how pressure could happen without movement.⁶³

In reply to Burman, Descartes notes that we can take a metal instrument or a piece of wood or metal and press it with our hands on either side in such a way that no motion is produced since the pressure and resistance on both sides are equal. In the same way, pressure from the matter of the second element is resisted by the pressure of the eye.⁶⁴

How can this concept of light as a force that causes pressure be reconciled with Descartes' concept of light as "un certain mouvement ou un action fort prompte et fort vive"? Is this a real contradiction or only an apparent contradiction? Descartes did not seem to think there was any contradiction:

Or d'avoir dit generalement en plusieurs endroits qu'elle est un mouvement ou un action & en un autre d'avoir dit qu'elle est qu'une action. Ce ne sont point deux choses qui se contredisent...Comme, lors qu'on dit de quelque

un qu'il est toujours en action, cela veut dire qu'il se remue toujours.⁶⁵

Descartes seems to suggest that it is only a matter of semantics. Why is it that Descartes can call the light a movement? Primarily because the movement of the sun sets up the action or inclination to rectilinear movement. While the sun does not move from place to place, it does have its own proper movement. The centrifugal force of the particles of the sun agitate in such a way (like a flame) that the sun causes pressure to be emitted from all of the points of its surface. The rays of the sun are the straight lines along which the pressure tends.⁶⁶ The rays are not light corpuscles, however, but simply the direction that the force takes. Nothing material passes from the light.⁶⁷ We must not think that the force of the sun is actually emitted in a true rectilinear direction, this is not the case. The same laws that apply to movement apply to the tendency to movement:

Car il est bien aise a croire que l'action ou inclination a se mouvoir que j'ai dit devoir etre prise pour la lumiere, doit suivre en ceci les memes lois que le mouvement.⁶⁸

What does this mean? Although the action of the light tends to move along straight lines and is emitted equally in all directions from the body of the sun, there is no actual rectilinear movement. When the rays meet certain bodies they are deflected by them or weakened in the same way that the movement of a ball thrown in the air is deflected by the

objects around it.⁶⁹ While the rays of light always tend to move rectilinearly, since there is no void, no actual rectilinear movement is possible. In effect, the rays are curved or bent lines; but because there is an infinite number of them, they are considered to be straight when they pass through the transparent medium.⁷⁰ At the instant that we open our eyes the pressure from the sun tends in a straight line towards our eyes. Yet, because the rays are impeded by other bodies they are never exactly straight when they reach us. However, in each instant that the action of the sun is transmitted, the tendency towards rectilinear movement persists. What can be said about that instant?

We know that the force of the light does not consist in "la duree de quelque mouvement" (cf. ftn. #62). When Descartes speaks of a durational movement he is thinking of a successive kind of movement that takes place in passing time. In this sense light is not a movement. The passage of light, like the elementary movements of circular motion, is effected in the instant:

Et ici m'entendant sur le sujet de la lumiere, j'expliquai, bien au long quelle estoit celle qui se devoit trouver dans le Soleil & les Etoiles, & comment de la elle traversoit en un instant les immense espaces des cieux & comment elle se reflechissoit des Planetes & des Cometes vers la Terre.⁷²

Since the action of light is conceived by Descartes to be the cause of all the elementary movements in the universe and since these movements take place in the instant, then what is

true of the 'instant' as it pertains to the elementary movements should be true of the 'instant' as it pertains to the action of light.

We have argued that the elementary movements have real finite speeds, and that the instant in which the movements take place is both measurable and divisible. If we are to find coherency in Descartes' theory of time in his physics, we should be able to find that the action of light has a real finite speed which takes place in a measurable and divisible instant. The following passage provides us with insight and can serve as a starting point for our inquiry:

En la lumiere, je ne considere pas le mouvement, mais l'action ou l'inclination a se mouvoir laquelle etant instantaneous ne peut diminuer.⁷³

On the basis of this particular text, Gueroult makes the following observation: "Descartes, considering that the instant cannot be diminished and is rigorously indivisible, concludes that elementary speed is also absolutely indivisible and that real movement (temporal) is derived from the repetition of these indivisibles."⁷⁴

Here Gueroult's claim is based upon questionable textual interpretation (only one of the problems of the topic). The first difficulty with Gueroult's interpretation is that not enough text is provided to make clear Descartes' intent. Secondly, there is an overreading of the text (making a subtle point on the basis of a text which seems to be saying something commonplace and straightforward). Thirdly, there

is misrepresentation of the text since subsequent portions of the text tend to negate the basis of Gueroult's interpretation. Finally, there is the failure to provide additional texts to support his claims.

Let us consider what Descartes actually says in the text and what he does not say. The first point to note is that he does not say that the instant is indivisible. Nor, in fact, does he say that the instant cannot be diminished. He says that the action or inclination cannot be diminished. Secondly, as regards the instantaneity of the action, one could propose that Descartes means nothing more by this than that the action occurs in the shortest time possible, that is, a time with a minimum duration. To assume more from this passage is to overread the text. More important, however, is the fact that Gueroult fails to cite the subsequent part of the text which reads as follows:

Et encore qu'elle diminueroit, il est certain que ce doit etre de fort peu, vu qu'elle ne se perd pas toute en venant du soleil jusqu'a nous, et ainsi que cela ne doit point etre considere.⁷⁵

There are two possible interpretations for this last text. In citing the first part of the text Gueroult insisted that the instant was indivisible because it could not be diminished. If this was what Descartes meant in that text, the second text would seem to refute it. For now Descartes says that, if the instant would be diminished (he does not say if it is or is not), it would have to be ever minutely diminished. Obviously, then he is not

maintaining a rigid position on the instant. Gueroult's interpretation is, no doubt, predictated on the thesis that in the first part of the text Descartes is actually saying that the instant cannot be diminished. However, this does not seem to be what Descartes is saying at all. In fact, we know from other texts, that it is the action which can be diminished as it passes through a vortex other than its own. Speaking about the light, which as we know from other texts, Descartes refers to as a 'force' (cf. ftn. #62), as well as an 'action', Descartes says:

Enfin la force de la Lumiere est non seulement plus ou moins grande en chaque lieu, selon la quantite des rayons qui s'y assemblent, mais elle peut aussi etre augmentee ou diminuee par les diverses dispositions des corps qui se trouvent aux lieux par ou elle passe. ⁷⁶

Considering this passage from the Traite de Lumiere, the point that Descartes seems to be making in his letter to Mersenne (which Gueroult failed to cite in full) is that, although the action would be diminished, the diminution would be very little since it would still have the force to produce its effect. In other words, if the sun lost any of its efficacy, it must only be slight since the empirical evidence is that the light and its reflection on the earth are contemporaneous. In the passage cited from Mersenne's letter there is no evidence that Descartes wishes us to understand that the instant cannot be diminished, and is, therefore, indivisible. Instead, Descartes wishes to emphasize the ontological priority of the light. At the

same time he wants to disavow its temporal priority since the light as a cause is simultaneous with its effect. This interpretation can be sustained.

The action of the light is a perfect example for illustrating that what is ontologically prior need not be temporally prior.

Car si la Lumiere, c'est a dire lux est l'action ou le mouvement dont le soleil pousse la matiere subtile qui l'environne...il ne suit pas de la qu'il soit premier que cette action, n'y qu'il en soit la cause efficient...si vous voulez qu'il soit premiere qu'elle ce sera seulement en meme facon que l'homme est premier que sa raison, en tant qu'il doit etre au exister avant qu'il puisse en user.⁷⁷

Light is not propagated according to a local movement measured in passing time. The action or movement of the sun means that the rays of the sun and its point of emission are simultaneous with its illumination of all of the parts of the hemisphere. To illustrate what he means, Descartes compares the action of the light to the movement of a stick in which both ends are moving at the same time:

Et pour tirer une comparaison de ceci, je desire que vous pensez que la lumiere n'est autre chose, dans les corps qu'on nomme lumineux, qu'un certain mouvement, ou une action fort prompte & fort vive, qui passe vers nos yeux, par l'extremite de l'air & des autres corps transparens, en meme facon que le mouvement ou la resistance des corps, que rencontre cet aveugle, passe vers sa main, par l'extremite de son baton... vous sçavez que l'action, dont on meut l'un des bout d'un baton doit ainsi passer en un instant jusques a l'autre et qu'elle (lumiere) devroit passer en meme sorte.⁷⁸

There is nothing in this text (nor in any other text that we could discover) which could lead us to say that instantaneity

is defined in terms of absolute indivisibility.

Further, if indivisibility means that there is no real finite speed, then this is more evidence that the instant is not conceived in terms of indivisibility. Considering that the light has to pass through different mediums, Descartes proposes that the speed of light is not always the same. Light is an action upon the subtile matter which fills the pores. But some of the matter is less disposed to receive the action. Where the light is impeded or weakened it loses some of its velocity. Contrary to this, if the medium is more disposed to receive the light its speed is augmented. A ball thrown in the air moves more rapidly when the wind blows on the side that is moving, and it moves less rapidly if the wind is blowing against the side that is moving. The same applies to the action of light.⁷⁹ We have seen that the action of light follows the laws of motion (cf. ftn. #68). Hence, the speed of light depends on the nature of the medium through which it passes. Light travels faster in a denser medium in the same way that a ball moves faster on a harder surface than on a softer one.⁸⁰ Moreover, regarding Descartes' discussion of the refraction of light rays, Fermat objected to Descartes' failure in La Dioptrique to distinguish between the pressure that is the determination for motion and the speed of the movement, noting that the determination could not have a speed.⁸¹ Descartes' response to Fermat was clear and to the point. As far as

Descartes was concerned, Fermat's objection was "contre mon sens & contre la verite," since

cette determination ne peut etre sans quelque vitesse bien qu'une meme vitesse puisse avoir diverses determinations, & une meme determination etre jointe a diverses vitesses.⁸²

Whether Descartes conceives the light to be the 'action' or movement, i.e., the transmission of light through the different media, or simply the determination or pressure, the light always has some finite measurable speed. There are certainly no indications that Descartes ever conceived the speed of light to be infinite.⁸³

When Descartes does speak about the speed of the movement of the light (cf. ftn. #61), he describes it as being "tres prompte & fort vive". The light is a pressure having "tres grande vitesse" (cf. ftn. #53). These are real speeds that can be conceived in terms of more or less, can fall under the category of magnitude and can be analogous to the extension of a body considered measurable and divisible.⁸⁴ Again, we see Descartes in Principles describing characteristics of light: "Son action est extremement prompte, elle separa presque en une instant toute la superficie de cette tache."⁸⁵ These descriptions of light, plus the fact that Descartes' espouses a medium theory of light which entails differences in the speed of light, lend weight to the opinion that Descartes believed the velocity of light to be finite.

Can Descartes give us a clearer picture of what he understands by the action of the light when he speaks of its instantaneity? We know that the sun appears on a point of the horizon and, in an instant illuminates the entire hemisphere, even to the extreme points of the earth. We also know that light passes through different mediums and reaches the earth in an instant, and when impeded, its speed gets modified. While there are variations in the speed of light as it traverses to the earth, it still remains true that the light and the reflection of its rays on the earth are simultaneous events. That simultaneity is an essential characteristic of the light and its importance is indicated in Descartes' letter to Beeckman.

When Beeckman proposed to Descartes that there was an interval of time between the emission of the light from the sun and the reception of its rays in the eyes, Descartes responded,

elle fait voir manifestement qu'il n'y a pas d'intervalle ni de retard de ce genre entre l'instant ou la lumiere sort d'un objet lumineux et l'instant ou elle entre dans nos yeux.⁸⁶

The import of this cannot be underestimated. On it rests the whole of Descartes' philosophy:

Et vous aviez tellement confiance en votre experience que vous declariez tenir pour faussee toute votre Philosophie, s'il n'y avait pas un intervalle entre l'instant...Je disais au contraire que, si on percevait un tel retard ce serait l'encroulement de toute ma Philosophie.⁸⁷

The instant denies neither speed nor time. It denies only causal temporal priority which would demand a delay between the emission of the rays of the sun and its reception by the eyes. There is no question that this is Descartes' view:

Et pour la difficulte que vous trouvez en ce qu'elle au mot instant; car il semble que vous le considerez comme s'il nioit toute sorte de priorite en sorte que la lumiere du Soleil puis ici etre produite sans passer premierement par tout l'espace qui est entre lui & nous; au lieu que le mot d'instant n'exclud que la priorite du temps, & n'empeche pas que chacune des parties inferieures du rayon ne soit dependante de toutes les superieures, en meme facon que la fin d'un mouvement successif depend de toutes ses parties precedentes.⁸⁸

What Descartes seems to be saying is that the light travels so incredibly fast that one could observe no interval between its transmission from the sun and its reflection on the earth. The instant excludes not only the 'before' but it excludes the 'after' because it excludes the concept of succession. However, it does not exclude the 'before' and 'after' absolutely, that is, in the sense that the instant is without temporality. What Descartes means is that the emission of the sun's rays did not occur before and after the rays on the earth were perceived. Descartes clearly points out that there is no time delay between the two events. The emission of the sun's rays and their reflection on the earth are simultaneous events, and in no way does the instantaneity of these events deny their temporality.

Simultaneity is a temporal concept that refers to

events taking place at the same time. If I simultaneously (at the same time) juggle four balls, two balls in my right hand and two balls in my left hand, that simultaneity does not mean that the time in which I juggled the four balls has no measurable and divisible duration. It only means that I did not juggle the two balls in my right hand before I juggled the two balls in my left hand. Clearly, the juggling of the balls is a simultaneous event that has temporal duration, since the time I started the juggling was before the time I finished.

Instantaneity is a characteristic of the transmission of light and its reflection on the earth. These events take place at the same time, and that time, the instant, is a measurable and divisible segment of time. This is made plain in the following text from the Principles:

[C]ar encore qu'il arrive quelquefois qu'elles se trouvent disposees en meme sorte que celles qui sont representees en cette figure, elles ne s'y arrestent neanmoins que ce peu de temps qu'on nomme un instant pource qu'elles sans cesse en action pour se mouvoir ce qui est cause qu'elles continuent leur mouvement sans interruption.⁸⁹

To Hyperaspistes he writes, "on ne sauroit admettre meme pendant l'instant le plus court....,"⁹⁰ clearly a description of the instant as a segment of time that has some measurable duration.

In defining the instant Descartes excludes the priority of time, the instant does not exclude temporality. In itself, it has duration, however brief that may be.

Descartes presents us with a quantitative description of the instant. It is a "peu de temps", "le plus court". Conceived in those terms, it may be included under the term magnitude which is per se both measurable and divisible. Although we may not be able to actually measure or divide the instant, Descartes leaves us with the idea that it is conceptually possible. Any other interpretation does not seem to be sustainable.

D. Discontinuous-Continuous Movement

We have seen that Descartes' physics comprehends the world where everything is extended in one unity and everything depends on everything else. Ceaselessly the world is undergoing instantaneous mutations. Yet, the variety and multiplicity of the particular configurations and the speeds at which the changes occur elude our perception.⁹¹ What we do perceive is continuous movement measured by passing time.⁹² The instantaneous mutations are imperceptible. This leads us to ask the question again, as we did in the second chapter, whether or not time is discontinuous. It is the position of Gueroult, Vigier, and others that discontinuous time fundamentally conditions our understanding of the Cartesian physics.⁹³ The fact is, however, that continuous time is the only kind of time that is actually verifiable in the order of experience.⁹⁴ Therefore, it must be demonstrated that continuous time is inconsistent with Descartes' mathematical physics. This

has not been done.

The fact that change takes place in the instant does not, in itself, prove that the instants are discontinuous, that is, that they are separate and independent in a manner that causes a rupture which prevents a true continuity from ever being realized.

Descartes seems to suggest that the instants are continuous:

[C]ar encore qu'il arrive quelquefois qu'elles se trouvent disposees en meme sorte que celles qui sont representees en cette figure, elles ne s'y arrestent neanmoins que ce peu de temps qu'on nomme un instant, pource qu'elles continuent leur mouvement sans interruption.⁹⁵

There are two possible interpretations. When Descartes says "sans interruption" he could mean there is no break in the actual continuity as we would find in the case of a true magnitude. Or, Descartes could mean that there is no break in the uniformity, that is, in the repetition of separate instantaneous mutations.

Descartes' discussion of the sun would seem to discredit the second interpretation. According to the laws of nature the flame, like all bodies, having been once formed, "continuerait d'etre" unless destroyed by some external cause. The flame, however, can be dissipated by the surrounding air, and for this reason, there must be "renaissance continuellement d'autre flame qui lui succede"; unlike the flame, "nous voyons pas que le Soleil soit ainsi dissipe par la matiere du Ciel qui l'environne; c'est pourquoi nous

n'avons pas sujet de juger qu'il ait besoin de nourriture comme la flamme."⁹⁶ Whereas the flame's continuous existence can be interrupted, the Sun enjoys a continuous existence without any interruption or possibility of non-existence initiated by an external cause. That continuity is not a repetition of renewals of existence, it is a continuity that is projected as an unbroken unity in which the Sun gives off its own light without any cessation of its existence. And time, as the measure of that duration, must share that continuity.

While the texts suggest that time is continuous, in pursuing the issue of the continuity of time, a broader reference must be used since it is the critics' contention that Descartes' physics is conditioned by discontinuous time. Hence, our reference must be Descartes' overall philosophical project to construct a mathematical kind of physics. What must be determined is whether discontinuous time is a condition for Descartes' mathematical physics. The fact that it is mathematical, in which case the laws of mathematics would apply to phenomena, does not, in itself, prove the case for discontinuous time. Insofar as mathematics deals with quantities, it treats both discrete and continuous quantity under the rubrics of arithmetic and geometry. We must look to see what Descartes had in mind when he envisioned his physics.

No doubt, in a world where everything is extended matter, and movement is defined in terms of instantaneous mutations, Descartes has fashioned a mathematical model to which one could seemingly apply laws of mathematics. The Principles is Descartes' most precise and systematized attempt to describe the physical universe and what he believed took place within that universe. In that treatise, Descartes constructs a mathematical model to which one could theoretically apply the laws of mathematics. The seven laws of impact found in the Principles are examples of what Descartes might have had in mind. These laws are nothing more than mechanical rules governing the changing relations among material particles. The laws are dominated by the principle that the same quantity of motion is conserved in each instant. Given the factors of size and speed, one can presumably determine how that motion will be divided between the bodies in contact. An example of what Descartes means can be found in the fifth rule, which reads in part:

Ainsi, apres que B auroit rencontre C, il iroit d'un tiers plus lentement qu'auparavant, c'est a dire qu'en autant de temps qu'il auroit pu parcourir auparavant trois espaces, il n'en pourroit plus parcourir que deux. Tout de meme si B etoit trois fois plus grand que C, il ne lui transfereroit que la quatrieme partie de son mouvement, & ainsi des autres.⁹⁷

Do these rules of motion and Descartes' general statements about motion presume the discontinuity of the instants? Gueroult contends it is the discontinuity of the instants

that makes it possible for Descartes to consider the elementary movement as geometrical relations which, in each instant, can be statistically determined.⁹⁸ If this were true, then presumably the movement of a body in each instant would seem to proceed in conformity with a mathematical rule. Moreover, to effect such a procedure, it would be necessary to envision what H. Bergson refers to as a 'cinematographic' kind of movement.⁹⁹ This concept of movement would be one in which each elementary instantaneous mutation was viewed like a slide of a movie projector. Each movement, like the slide, would be distinct and separate.

The question seems to be whether Descartes' physics was meant to be applied to specific cases; or whether it was intended to provide general laws and mechanical models about possible patterns of behavior. If they are only general laws, then the instant would not have to be discontinuous since statistical measurement of the particular instants would not even come into question. There is simply no evidence that Descartes ever envisioned that his physics could actually make it possible to statistically measure the elementary instantaneous movements. Given the nature of the Cartesian physics, it would be impossible for us, to actually formulate any simple mathematical laws regarding particular instances. The primary reason is that the world is a plenum of contiguous bodies undergoing constant change, hence, we cannot isolate phenomena. Descartes was

aware that in such a world we can never know all of the determinate ways in which the parts of matter are divided nor at what speeds they are moving, and, therefore, one cannot formulate any mathematical laws regarding particular phenomena.¹⁰⁰

Nor can we dismiss the fact that the Principles were intended to be only descriptive. Therefore, whatever laws are formulated cannot be used to prove anything. The laws yield only a conjecture about the likely patterns according to which nature acts.¹⁰¹ Descartes' aim is to show how natural bodies could be made in terms of his mechanical models, although one ought not to conclude that they are really made in this fashion.¹⁰² E. Brehier and J. Collins rightly point out that the Principles do not contain mathematically expressible laws. Descartes' philosophy of nature, then, is not intended to convey pure and absolute certitude but only a moral certitude sufficient to increase our practical grasp of the visible.¹⁰³ While Descartes believed that some general principles might be known with certitude, he was forced to admit that in particular cases experiment is vital and in itself inconclusive.¹⁰⁴ Certainly this admission by Descartes does not leave us with the belief that he ever intended his mathematical physics to function in such a way as to ever be able to statistically determine movements of particular bodies. The conclusion we must reach is that no evidence has been presented by others, nor

found by us, that Descartes' physics is conditioned by discontinuous time. What we find is that continuous time is totally compatible with the Cartesian world where everything is moving "sans interruption."

There is little question that Descartes discusses movement in terms of instantaneous elementary movements. We have seen how he does this in the case of circular movement and in his theory of the instantaneous transmission of light. Moreover, given that the nature of matter is extension, one has clear evidence that Descartes envisioned a mathematical kind of physics, one which always remained within the bounds of human limitations. Physical time is a reality for Descartes, because it is a property of extended substances and a descriptive feature of their duration. Granted that the world is a plenum of extended substances, nevertheless we observe these substances exist, and for them to exist is to endure. That duration which is analogous to extension¹⁰⁵ as continuous quantity can be measured. And time is the measure. Since duration is measurable it is also divisible into moments, and thus duration has a quantitative character to it. Time, as a correlative of duration, assumes that same character. There is a continuity and divisibility that is manifest in the world. For extended substances are ceaselessly undergoing change. This is possible because they have a continuous duration that is divisible, and the possibility of measuring duration and

separating the moments always persists.

The condition for that measuring and dividing is the thinking substance. While time is a property of all substances, it is more. There is a psychological aspect of time. It is the way in which we think about the duration of substances.¹⁰⁶ What does this mean? First of all, it means that the thinking substance can measure duration with a temporal measure of moments, hours, days, years, etc. Secondly, it means that it can divide the duration into parts of 'before' and 'after' and temporally conceive of these as one minute, two minutes, etc., or one year, two years, etc.

More importantly, the thinking substance can focus on any single moment that exists in an order of 'before' and 'after' and describe what takes place in that space of time. Descartes has done this by providing us with an account of how he perceives bodies to behave in an instant. He has described how the action of light is transmitted, and how that action is manifested in the instantaneous elementary movements of circular motion. Descartes has recorded the events that have taken place in one moment of time, the instant.

We have seen, then, that extension is a property of material substances. But time is a property of both material and thinking substances. Insofar as these substances endure, time can serve to measure their duration.

Having seen how time functions in relation to material substances, our dual perspective approach to time dictates that we turn our attention to the thinking substance. As we examine time from this perspective, we must keep in mind Descartes' metaphysical dualism. We have seen that Descartes has a coherent theory of time in his physics, What we hope to find is a coherency between the 'time' that measures the duration of the material substances and the 'time' that measures the duration of thinking substances.

The material world is projected by Descartes as an object of knowledge, and the duration of material substances is manifested in terms of that purpose. Descartes' metaphysics of the thinking substance is designed to meet the exigencies of his mathematical physics that requires an agent of knowing. Hence, the duration of the thinking substance is fundamentally manifested in terms of its essential nature as a subject whose cognitive activities establish it as an agent of knowing empowered to attain some degree of certitude about the phenomena in nature. It is from that dimension that we must consider the temporality of the thinking substance as it unfolds in the mental events which constitute its duration.

NOTES - CHAPTER III

¹Alexandre Koyre, Galileo Studies (New Jersey 1978), p. 91.

²A. G. Balz, Descartes and the Modern Mind (New Haven 1952), p. 263; Y. Belavel, p. 110; Martial Gueroult, Etudes sur Descartes, Spinoza, Malebranche et Leibnitz (New York 1970), p. 88; J. Vigier, p. 200.

³Prin. I, 57, A.T. IX, p. 49.

⁴A Mersenne, Oct. or Nov. 1631, A.T.I., p. 228.

⁵Prin. II, 4, A.T. IX, p. 65.

⁶J. Vigier, p. 204.

⁷A Mersenne, 18, December, 1629, A.M. I, pp. 98-99.
 "In your last letter you ask me why I say that the speed is impressed by the gravity as one in the first moment of fall, and as two in the second moment, etc. I reply, with all due respect, that this is not what I meant; rather, that the speed is impressed by the gravity as one in the first moment, and again as one in the second moment by the same gravity, etc. Now, one in the first moment and one in the second, make two, and one in the third make three and thus (the speed) increases in arithmetical proportion...From which it certainly follows that if you let a cannonball fall in spatio plane vacuo from a height of 50 feet, whatever it is made of it will always take exactly three times as long for the first 25 feet as for the last 25 feet; cf. A Mersenne, 13, November, 1629.

⁸A Mersenne, Oct. or Nov. 1631, A.T. I, p. 230; A Mersenne, 11, October, 1638, A.T. I, p. 386.

⁹A Mersenne, Oct. or Nov. 1631, A.T. I, p. 228.

¹⁰A Mersenne, 12, September, 1638, A.T. II, pp. 353-354.
 "The first thing one must be concerned about is the fact that many have been accustomed to confound the consideration of space with that of time or speed. If I wished to join the consideration of speed with that of space, it would have

been necessary to attribute three dimensions to the force, whereas I have only attributed two in order to exclude it." Cf. A Mersenne, 15, November, 1638, A.T. II, p. 433.

¹¹A Mersenne, 11, March, 1640, A.T. III, p. 37. "You say that the speed of the hammer astonishes Nature, in such a way that it does not cease to join its forces in order to resist this is entirely against my opinion; for it has no forces to join, no need of time for that, but it acts totally mathematically."

¹²A Beaune, 30, April, 1639, A.T. II, pp. 542-543. "I wish to be able to respond to what you wish regarding your Mechanics; but even though all my Physics is nothing else but Mechanics I have never particularly envisaged those questions which depend on measures of speed."

¹³A Mersenne, 22, June, 1637, A.T. I, p. 392. "I must ask you to excuse me if I do not reply to your question regarding the slowing down of a heavy body's motion by air in which it is moving. For this depends on so many things that I cannot give a clear account of it in a letter; all I can say is that neither Galileo nor anyone else could work out anything clear and demonstrative on this question unless they first knew what gravity is, and unless they have the true principles of physics."

¹⁴Prin. II, 4, A.T. IX, p. 65; Prin. II, 1, A.T. IX, p. 64.

¹⁵Prin. II, 23, A.T. IX, p. 75.

¹⁶Prin. II, 25, A.T. IX, p. 76. "...the transference of one part of matter or of one body, from the vicinity of those bodies immediately contiguous to it and considered as at rest, into the vicinity of others."

¹⁷Traite de lumiere, A.T. XI, p. 54 (hereafter cited as Traite). Prin. III, 65, A.T. IX, pp. 136-137.

¹⁸Prin. II, 33, A.T. IX, p. 81. "It has been shown above that all places are full of bodies and that the size of each part of matter is always exactly equal to that of its place; so that it is not possible for it to fill a bigger one or to fit into a smaller one, or for any other body to find room in its place while it is there. From this it follows that no body can move except in a complete circle of matter or ring of bodies which all move at the same

time; in such a way that it drives another body out of the place which it enters, and that other takes the place of still another, and so on until the last, which occupies in the same instant the place left by the first."

¹⁹J. Wahl, p. 25.

²⁰M. Gueroult, Descartes selon l'ordre des raisons, pp. 282-283.

²¹Prin. II, 36, A.T. IX, pp. 83-84. "For although motion is only a mode of the matter which is moved, nevertheless there is a fixed and determined quantity of it, which is never increased or diminished...although there may at times be more or less motion in certain of its individual parts. That is why we must think that when one part of matter moves twice as fast as another twice as large, there is as much motion in the smaller as in the larger; and that whenever the movement of one part decreases that of another increases exactly in proportion."

²²Prin. II, 46-52, A.T. IX, pp. 87-93. Rule one is an instance of a case where the motion is unchanged, i.e., the bodies would lose none of their speed and they would spring back after contact in the same way. The remaining rules are cases where the action is changed in terms of speed and direction.

²³Prin. II, 50, A.T. IX, p. 91.

²⁴Prin. II, 34, A.T. IX, p. 83.

²⁵Prin. II, 33, A.T. IX, pp. 81-82. "[A]ll the matter contained in the space EFGH can move in a circle. The part of which is near E can move toward G and that which is near G can simultaneously move toward E, provided only that (since we are supposing the space at G to be four times as wide as at E, and twice as wide as at F and H) we also suppose the movement to be four times as rapid at E as at G, and twice as rapid as at F and H. Similarly, in all remaining places, we can suppose that the speed of movement compensates for narrowness of space. Thus, in any given space of time, the same quantity of matter will pass through one section of the circle as through another." Cf. Traite, A.T. XI, p. 19.

²⁶Regle XIV, Pleiade, p. 97.

²⁷Ibid., pp. 103, 104, 105.

²⁸Prin. II, 10, A.T. IX, p. 68.

²⁹Prin. III, 87, A.T. IX, p. 152. "Moreover, it is impossible to point out between F and D, a single one of these scrapings, however small, which is not larger than the one which is removed from the line FD at each moment, because all during the moments of time that the globule C approaches B, it shortens line DF, causing it to be of innumerable different degrees of shortness successively."

³⁰'Moment' and 'instant' are used in the same context for Descartes. A Plempius, 15, February, 1631, A.T. I, p. 529; cf. ftns. #29 and #30 in Chapter II.

³¹Prin. II, 50, A.T. IX, p. 91. "[T]herefore after B had collided with C, its speed would be reduced by one-third; that is to say, B would then need as much time to travel a distance of two spaces as it previously did to travel a distance of three spaces."

³²Regle XIV, PLeiade, p. 97.

³³Prin. I, 57, A.T. IX, p. 50; Regle XIV, Pleiade, p. 103.

³⁴A Mersenne, 26, April, 1643, A.T. III, p. 650. "Movement is not a real quality, one can conceive it to be nothing else except the change by which a body is separated from others [bodies], and there are only two properties of it to consider; the one, that it can be more or less swift; and the other, that it can have different directions."

³⁵M. Gueroult, Descartes selon l'ordre des raisons, pp. 282-283.

³⁶A Mersenne, 16, October, 1639, A.T. II, pp. 592-593. "And I can only say that it implies a contradiction [to say] that there is an infinite speed in nature." Cf. A Mersenne, 29, January, 1640, A.T. III, p. 11. In his letter to Mersenne, Descartes refutes Galileo's claim that a stone descending in the void would have an infinite speed. Descartes considered the thesis that anything could have an infinite speed to be totally "l'absurde". Also, as Descartes clearly pointed out in his letter to Clersier, it was contradictory to think (as Bayle did) that any finite line could

be made up of infinites. Cf. A Clersier, June or July, 1646, A.T. IV, pp. 445-447. This would seem to apply equally to movement since a body moving between two points would be analogous to a line and just as the line cannot consist of actual infinite parts, neither can a finite movement be composed of elementary movements made up of infinite speeds.

³⁷Prin. II, 34, 35, A.T. IX, pp. 82-83.

³⁸A More, 5, February, 1649, A.T. V, pp. 272-273; Traite, A.T. XI, p. 12.

³⁹Prin. III, 59, A.T. IX, p. 132. "I know the motion of this ant must indeed be very slow at the beginning, and its striving judged only by this initial motion, cannot seem very great; yet the striving cannot be said to be non-existent, and since it increases as it produces its effect, in a little bit of time the movement which results can become quite rapid...In the first moment when we begin to rotate this tube around the center E, the globe will advance only slowly toward Y."

⁴⁰A Mersenne, 9, January, 1939, A.T. II, p. 484. "Because there is no void, it is always necessary that there be found such a matter whose parts are so small and move so extremely fast that the force by which they encounter the other bodies is sufficient to make them change their figure, and accommodate themselves to the places where they find themselves."

⁴¹Traite, A.T. XI, p. 34. English version contained in Rene Descartes' Le Monde, ou Traite de la Lumiere, translated and introduction by Michael Sean Mahoney (New York 1979), p. 55. "From the first instant that they are created, He makes some begin to move in one direction and others in another, some faster and others slower (or indeed, if you wish, not at all); thereafter, He makes them continue their motions according to the ordinary laws of nature."

⁴²Prin. III, 46, A.T. IX, p. 124. "But we have not been able to determine in a similar way the size of the parts into which this matter is divided, nor at what speed they move, nor what circles they describe. For these things have been ordained by God in an infinite number of different ways."

⁴³Prin. II, 39, A.T. IX, p. 86; Prin. II, 33, A.T. IX, p. 81; Traite, A.T. XI, p. 44.

⁴⁴Traite, A.T. XI, p. 44.

⁴⁵Ibid.

⁴⁶Prin. II, 39, A.T. IX, p. 86; Prin. II, 33, A.T. IX, p. 81; Traite, A.T. XI, p. 44.

⁴⁷A Mersenne, 23, December, 1630, A.T. I, p. 194. "I tell you that I am now clearing up the confusion in order to elicit from the light, which is one of the highest and most difficult matters that I can attempt, for all of the physics is understood by that."

⁴⁸Prin. III, 52, A.T. IX, p. 128; Prin. III, 64, A.T. IX, p. 136. These are not three separate kinds of matter. All matter is essentially the same, although there are distinctions in matter in that some of the parts have different shapes and move in different ways. The three elements simply reflect distinctions in the manner in which these parts are disposed to move and the relationship that these movements have in regards to the light. All the variations in matter, including the variations of the three elements, are reducible to the sole fact that matter is divisible and its parts movable. Cf. Prin. II, 23, A.T. IX, p. 75.

⁴⁹Prin. III, 21, A.T. IX, 110.

⁵⁰Prin. III, 25-31, A.T. IX, pp. 112-116.

⁵¹Prin. III, 55, A.T. IX, pp. 130-131. "I shall now try to explain as accurately as I can, (the nature of) the force by which the (little) globules of the second element, and also the matter of the first which has accumulated around the centers S,F (around which they revolve), attempt to move away from these centers. For I intend to show further on that light consists entirely in this force (or effort), and many other things depend on this knowledge."

⁵²Prin. IV, 28, A.T. IX, p. 215. "As to the light, which is the third action that we are considering, I think I have already explained its nature; it remains only necessary to remark that...all of its rays come in some way from the

sun, and is nothing other than a certain pressure which occurs along straight lines drawn from the Sun to the bodies they encounter, nevertheless they cause different movements in the parts of the third element, of which the highest region of the earth is composed."

⁵³A Morin, 13, July, 1638, A.T. II, pp. 214-215.

⁵⁴Ibid., p. 209. "[F]or if the light, that is to say the luminary, is the action or the movement by which the sun pushes the subtile matter which surrounds it...it does not follow from that that its action is first, only that it is the efficient cause."

⁵⁵Response V, Pleiade, p. 492. Adam and Tannery do not include the fifth set of objections in their edition of the works of Descartes.

⁵⁶Prin. II, 36, A.T. IX, p. 83. "As far as the first cause is concerned, it seems obvious to me that this is none other than God Himself, who (being all powerful) in the beginning created matter with both movement and rest; and now maintains in the sum total of matter, by His normal participation, the same quantity of motion and rest as He placed in it at that time." Cf. Traite, A.T. XI, pp. 43, 46; A Mersenne, 27, May, 1630, A.T. I, p. 152.

⁵⁷A Mersenne, 18, November, 1640, A.T. III, p. 245. "The response that you have given is good, that is, when God said: Let us make Light, he made the parts of matter move, giving them their inclination to continue that movement in a straight line since that is what light is."

⁵⁸A Morin, 13, July, 1638, A.T. II, p. 209.

⁵⁹A Ciermans, 23, March, 1638, A.M. II, p. 200. "For the light, I do not understand the movement itself, but the inclination or propension to movement."

⁶⁰La Dioptrique, A.T. VI, p. 129. "...a movement or an action which tends to cause some movement."

⁶¹Ibid., p. 84. "[T]he light is a certain movement or an action very prompt and very lively which passes towards our eyes, through the extremity of the air and other transparent bodies."

⁶²Prin. III, 63, A.T. IX, p. 135. "...the force of the light...does not consist in the duration of some movement but only in the pressing or first preparation for motion, even though actual motion may not result from this pressure."

⁶³Ent. avec Burman, Pleiade, p. 1391.

⁶⁴Ibid.

⁶⁵A Morin, 13, July, 1638, A.T. II, p. 204. "But to have said in many places that it is a movement or an action and in another to have said that it is only an action. These are not two different things that are contradictory... As when one says that something is always in action, is to say that it is always moving." Cf. Stephen H. Daniel, "The Nature of Light in Descartes' Physics", Philosophical Forum, Vol. 7, 1976, pp. 323-344. Daniel gives a detailed explanation of how the conatus, i.e., the pressure or the determination to movement and movement itself are reconciled in Descartes' physics, resulting in a theory of light that is neither contradictory nor incoherent.

⁶⁶La Dioptrique, A.T. VI, pp. 86, 88; Prin. III, 130, A.T. IX, p. 181.

⁶⁷La Dioptrique, A.T. VI, p. 86; Prin. III, 64, A.T. IX, p. 136.

⁶⁸La Dioptrique, A.T. VI, p. 89. The English translation of the French will be cited according to the Olscamp edition. Discourse on Method, Optics, Geometry and Meteorology, translated by Paul J. Olscamp (New York 1961), p. 70. "For it is very easy to believe that the action or the inclination to move which I have said must be taken for light, must follow in this the same laws as does movement." Cf. A Mersenne, 5, November, 1637, A.T. I, p. 45.

⁶⁹La Dioptrique, A.T. VI, p. 89.

⁷⁰Ibid., pp. 88, 104; Traite, A.T. XI, p. 100.

⁷¹A Mersenne, 5, October, 1637, A.T. I, p. 451; Traite, A.T. XI, pp. 44-45.

⁷²Disc., A.T. VI, p. 43; H.R. I, p. 108. "And enlarging on the subject of light, I here explained at length the

nature of the light which would be found in the sun and stars, and how from these it crossed in an instant the immense space of the heavens and how it was reflected from the planets and comets to the earth."

⁷³ A Mersenne, 30, September, 1640, A.T. III, p. 193. "In the light I do not consider the movement, but the action or inclination to move, which being instantaneous cannot be diminished."

⁷⁴ M. Gueroult, Descartes selon l'ordre des raisons, p. 273.

⁷⁵ A Mersenne, 30, September, 1640, A.T. III, p. 193. "Even though it would be diminished, it is certain that it must be very little, seeing that it would lose nothing at all in coming from the sun to us, and hence, that cannot be considered."

⁷⁶ Traite, A.T. XI, p. 103. "Finally the force of the light is not only greater in each place according to the quantity of the rays which are assembled there, but it can also be augmented or diminished by the diverse dispositions of the bodies that are found in the places through which it passes." Cf. *ibid.*, p. 98.

⁷⁷ A Morin, 13, July, 1638, A.T. II, p. 209. "...for if the light, that is to say the luminary, is the action or the movement by which the sun pushes the subtile matter which surrounds it...it does not follow from that that its action is first, only that it is the efficient cause...if you wish to say that it is first it would only be in the same way that man is first as regards his reason, inasmuch as he must exist in order to be able to exercise his reason."

⁷⁸ La Dioptrique, A.T. VI, pp. 83-84. Olscamp, p. 67. "And in order to draw a comparison from this I would have you consider light as nothing else, in bodies that we call luminous, than a certain movement or action, very rapid and very lively, which passes towards our eyes through the medium of the air and other transparent bodies in the same manner that the movement or resistance of the bodies that this blind man encounters is transmitted to his hands through the medium of his stick...you know that the action with which we move one of the ends of a stick must be transmitted in an instant to the other end and that it (light) would have to pass in the same way." Cf. A Mersenne, 5, October, 1637, A.T. I, p. 45; Traite, A.T. XI, p. 99; A Morin, 13, July, 1638, A.T. II, p. 215.

⁷⁹ La Dioptrique, A.T. VI, p. 103; Les Meteores., A.T. VI, pp. 333-334; Prin. III, 84, A.T. IX, p. 150; Prin. III, 148, A.T. IX, p. 195; Prin. 130, A.T. IX, p. 181; Prin. II, 38, A.T. IX, p. 85.

⁸⁰ La Dioptrique, A.T. VI, p. 103.

⁸¹ Fermat a Mersenne, April or May, 1637, A.T. I, p. 358.

⁸² A Mydorge, March, 1638, A.T. II, p. 18. "...that determination cannot be without some degree of speed and different determinations could have the same speed, or the same determinations could have different speeds."

⁸³ J. F. Scott and John Burke are both of the opinion that Descartes could never have regarded the speed of light as infinite considering his frequent references to the ratio of speeds in different media. What they acknowledge is that Descartes believed the velocity of light to be so great that there was no means of measuring the interval of its passage from one terrestrial object to another. By an instant Descartes simply means an inconsiderable time, that is, an extremely short time. Cf. J. F. Scott, The Scientific Work of Rene Descartes (London 1952), p. 41; John Burke, "Descartes on the Refraction and the Velocity of Light," American Journal of Physics 34 (1966), p. 394. Cf. A. Koyre, p. 119, regarding his belief that Descartes did not sustain a theory of light that proposed the infinity of speed.

⁸⁴ Regle XIV, Pleiade, p. 97.

⁸⁵ Prin. III, 111, A.T. IX, p. 167. "...its action is extremely rapid, it will be separated from the surface of the spot almost in an instant."

⁸⁶ A Beeckman, 22 August, 1634, A.M. I, p. 268. "[I]t is manifestly clear that there is no interval nor any retardation of that kind between the instant where the light is drawn from a luminous object and the instant where it is reflected in our eyes."

⁸⁷ Ibid. "And you are so confident in your experience that you declare it would make your entire philosophy false, if there was not an interval between the instant...I say on the contrary that, if one perceived a delay my whole Philosophy would collapse."

⁸⁸ A Mersenne, 27, May, 1638, A.T. II, p. 143. "As to the difficulty you find in light being communicated in an instant, there is an ambiguity in the word d'instant. For you seem to hold that it negates any kind of priority as if the light of the Sun could be here produced without passing through all the spaces between it and us. Not so, the word d'instant excludes only priority of time, and therefore places no difficulty in the way of viewing each of the lower parts of the rays as being dependent on all its upper parts, as truly as the end of a successive movement depends on all its preceding parts." Cf. A Mersenne, 5, December, 1637, A.T. I, p. 451.

⁸⁹ Prin. III, 63, A.T. IX, p. 135. "[F]or, although it sometimes happens that they are arranged like those shown in this figure they however only remain in this position for that little space of time we call an instant, because they are perpetually in motion and so continue to move without interruption."

⁹⁰ A Hyperaspistes, August, 1641, Pleiade, p. 1133. "...one could not admit even in the briefest instant..."

⁹¹ Traite, A.T. XI, pp. 11, 19; Prin. III, 46, A.T. IX, p. 124.

⁹² Prin. III, 46, A.T. IX, p. 128; A Mersenne, 11, March, 1640, A.T. III, p. 41.

⁹³ Emilie Brehier, La Philosophie et son passe (Paris 1940), p. 137; F. Alquié, p. 54; M. Gueroult, p. 285. J. Vigier, p. 322.

⁹⁴ Prin. III, 46, A.T. IX, p. 128; A Mersenne, 11, March, 1640, A.T. III, p. 41.

⁹⁵ Prin. III, 63, A.T. IX, p. 135. "[F]or although it sometimes happens that they are arranged like those shown in this figure they however only remain in this position for that little space of time we call an instant, because they are perpetually in motion and so continue to move without interruption"; cf. Traite, p. 11, "[I]l est impossible que leur mouvements cessent jamais."

⁹⁶ Prin. III, 22, A.T. IX, p. 111. "...continues to exist...there must be a continual renewal of the succeeding flame; ...we have seen that the Sun is not dissipated by the

surrounding matter and for this reason does not need to be nourished like the flame."

⁹⁷Prin. II, 50, A.T. IX, p. 90. "Therefore, after B had collided with C, its speed would be reduced by one-third; that is to say, B would then need as much time to travel a distance of two feet as it previously did to travel a distance of three feet. Similarly, if B were three times as large as C, it would transfer to C one quarter of its motion; and so on."

⁹⁸Gueroult, pp. 275, 278; cf. Gueroult's Etudes, p. 91.

⁹⁹Henri Bergson, p. 295.

¹⁰⁰Prin. II, 53, A.T. IX, p. 93; Prin. III, 46, A.T. IX, p. 124; Prin. IV, 1, A.T. IX, p. 201; Prin. III, 83, A.T. IX, p. 149.

¹⁰¹Prin. III, 4, A.T. IX, pp. 104-105; Prin. IV, 1, A.T. IX, p. 149. Descartes' mathematical physics seems to be somewhat of an anticipation of the modern quantum theory. This theory proposes to formulate equations about the positions, motions, etc. of particles at one instant with knowledge of the positions, motions, etc. of particles at the next instant. At best, this yields a theory of probability. Cf. Arthur Eddington, The Philosophy of Science (Cambridge 1958), pp. 89-105, for a detailed analysis of the epistemological consequences of the quantum theory.

¹⁰²Prin. II, 64, A.T. IX, p. 101; Prin. 204, 205, 206, A.T. IX, pp. 323-324; cf. James Collins, Descartes' Philosophy of Nature (Oxford 1971), p. 74.

¹⁰³Emile Brehier, Histoire de la philosophie (Paris 1928), Vol. II, pp. 97ff.; cf. Collins, pp. 93ff.

¹⁰⁴Disc. A.T. VI, pp. 63-64; Prin. II, 53, A.T. IX, p. 93.

¹⁰⁵Ent. avec Burman, Pleiade, p. 1358.

¹⁰⁶Prin. I, 57, A.T. IX, p. 50.

CHAPTER IV

DURATION AS A TEMPORAL EVENT

Things have a knowable essence. They are made up of a particular number of constitutive elements; the cognition of which can be absolutely certain.¹ However, as the Discourse and Meditations both confirm, the discovery of the existence and nature of the thinking substance is epistemically prior to the discovery of all other things. One of the purposes of these writings is to overthrow skepticism by establishing that truth exists. The other purpose is to establish the efficacy of the thinking substance as an agent of knowing durationally. Endowed with a faculty for attaining truth, the thinking substance constitutes the noetic foundation for all knowledge. It is possible to attain knowledge and "ainsi nous rendre comme maistres & possesseurs de la Nature."² For these reasons, one must analyze the efficacy of the thinking substance as it reveals itself in temporal durations.

Not only is the thinking substance epistemically prior to material substances, it is ontologically prior because, unlike material substances, the thinking substance has an intrinsic principle of action. Defined as a substance who thinks, wills, understands, believes, opposes and denies,

the thinking substance is fundamentally a concrete person and "le sujet de quelques actes."³ Thinking is an action and "toutes nos actions se font dans le temps."⁴ The temporality of the thinking substance is singularly manifested in terms of cognitive actions, and these actions constitute the mental events that make up the temporal duration of the thinking substance.

While the knower maintains his radical essential distinction from things in the physical order, the knower and known are correlative concepts which suggest that there is some degree of affinity between the two kinds of substances. Common to all substances are such properties as their existence, unity, order and their duration.⁵ The common successive duration of all substances means that things, like thought, exist. Things in the physical order have essential knowable components and the simultaneous coexistence of the knower and known brings the knower in contact with the known whereby the latter becomes a possible object of knowledge.

It is incumbent on the knower to "accroître la lumière naturelle de sa raison" so that he may reap the fruits of scientific inquiry.⁶ This scientific inquiry ideally will lead to an intellectual vision that is imbued with the same certitude and clarity characteristic of mathematics. Descartes' epistemology is intended to show us how the mind can attain that degree of cognitive force

precisely through durational knowledge. For while the truth is eternal, the actions by which the knower must come to see the truth are temporal events in the duration of the thinking substance.

A. Intuition as Durational

Descartes had a firm conviction that of all the sciences mathematics alone furnishes us with an illustration of self-evident and certain knowledge⁷ which, if durational, models all other durational knowledge. Convinced that all the sciences could be comprehended as one, Descartes believed that whatever method was used in mathematics could justifiably be used in every scientific pursuit.⁸ The dynamics of this method was the primary concern of Descartes' earliest philosophical work which he entitled Rules for the Direction of the Mind. In it Descartes set down a method for achieving self-evident knowledge in the sciences.⁹

The method set down in the Rules is the one used in the science of mathematics: No science is acquired except by mental intuition or deduction, for these acts constitute the way to truth:

Pour ne tomber ensuite dans la meme erreur, nous allons enumerer ici tous les actes de notre entendement, par lesquels nous pouvons parvenir a la connaissance des choses sans aucune crainte d'erreur; il n'y en a que deux; l'intuition et la deduction.¹⁰

Although for the most part Descartes abandoned the use of the term 'intuition', it is apparently not because he had any problems with it. In the original Latin version of the

Second Responses, Descartes refers to the "cogito, ergo sum" as a "simplici mentis intuitu".¹¹ Moreover, Descartes continued to use the term "connaissance intuitive" in his correspondence, a further indication that the term was not limited to the Rules and that it captured the meaning Descartes intended.¹²

That meaning is projected in terms of a metaphor. When Descartes speaks about intuitive knowledge we find him clarifying it as "lumiere naturelle ou intuitus menti".¹³ The metaphoric implication attached to the term 'intuition' is noteworthy. What it indicates is that Descartes wishes us to understand intuition as somewhat analogous to physical sight and to the action whereby we see things in the physical order.

Descartes' entire philosophy is linked to his theory of light. In the physical order the action of light is ontologically prior to all movement. Analogously, in the spiritual order the act of cognition of the "lumiere naturelle" is the highest kind of action. Intellectual vision of "la faculte de connaitre" that "nous appelons lumiere naturelle" is akin to sense knowledge.¹⁴ The action of the light is the cause of the light being seen on the earth.¹⁵ Analogously, it is through the action of the "lumiere naturelle" that the knower comes to see the truth. It is always a matter of seeing what is able to be seen with the "lumiere naturelle". In the order of experience, we

know that the action of physical seeing is a temporal event in which what is present is visible to the eye. If temporality is a feature of physical seeing, no less is it a feature of intellectual vision.

Intuition as a method of correct thinking is a mental event that takes place in time. That time is the present when the mind attends to the actual evidence. It is always a matter of seeing something in the "meme temps" and "non successive".¹⁶ Successive time includes the past as well as the future. Intuition excludes those parts of time. All that is seen is seen in a present time which is liberated from forgetfulness and doubt. These latter characterize respectively the past that no longer exists and the future that does not yet exist.

The "cogito" as a "simplici intuitu" is the primary example of the temporality of intuition; "I am", "I exist", is necessarily true all the time that I pronounce it or conceive it.¹⁷ Implicit in that intuition is the presence of what is seen by the mind's eye. Every time that I think, I see that my thinking necessarily implies my existence. The "cogito" as an intuition is a case of seeing that my present thinking is the actual evidence of the necessity of my present existence. The existential aspect of intuition is not, however, unique to the "cogito", it is an aspect of all intuition as a mental vision. It is seeing what is present in the present time.

While time is fundamentally successive, it has also a simultaneous aspect wherein things are said to exist at the same time. This coexistence makes it possible to see the presence of a coexistent thing and to affirm its presence. Just as in the physical order something must be present to be seen, intellectual vision demands an actual object. Something must be present to the understanding. It is not a question of spatial presence but of temporal presence. The present measures the actual, namely, that which has actual temporal existence. To understand the present as that part of time in which intuition takes place is to understand it always in relation to some actual object which is 'present' to the mind and to which the mind can attend reflectively. What is clear is what is present to an attentive mind:

Par intuition j'entends, non pas le temoignange changeant des sens ou le jugement trompeur d'une imagination qui compose mal son objet, mais la conception d'un esprit pur et attentif, conception si facile et si distincte qu'aucun doute ne reste sur ce que nous comprenons; ou, ce que est la meme chose, la conception ferme d'un esprit pur et attentif, qui nait de la seule lumiere de la raison et qui, etant plus simple, est par suite plus sure que la deduction.¹⁸

Intellectual vision obeys the same laws as physical vision. If something is present to the faculty of sight the latter necessarily sees what is there. In the same way, the mind is of such a nature that it cannot help assent to what is present to it. "L'entendement ne peut jamais etre trompe par une experience, s'il se borne a avoir l'intuition nette

de ce qui se present a lui."¹⁹ While the self-evidency of the truth characterizes intuition, something more is suggested in the above Rule. There is, on the part of the understanding, a certain passivity; it must affirm what is there present to it.

Yet, intuition is a form of thinking and thinking is an action analogous to sensible vision since "chacun peut voir par intuition qu'il existe."²⁰ On the one hand, Descartes maintains that thinking is an action. On the other, it remains true that the understanding is passive since it cannot deny the truth when the evidence is present to it. Descartes finds no difficulty with the disparity. The power of knowing, Descartes tells us, is sometimes passive and another time active, sometimes the seal and sometimes the wax.²¹ Like a seal that can receive diverse figures, the soul can receive diverse ideas and the receiving is not properly an action but a passion, "qu'il n'y a ses volontez qui soient des actions."²² True; the nature of man is simply to think. And yet, willing, understanding, imagining, sensing, etc. are just different ways of thinking and all belong to the same indivisible soul.²³

The Cartesian method is grounded on the efficacy of the thinking substance as an agent of knowing. However, the essence of that method resides in attention in which the determining element is the will. The seat of all actions is the will which must adapt the attention to the true ideas.

Attention is that methodical factor which conditions the pure intellectual activity of the mind since attention is necessary to avoid the dispersion of the mind over too many irrelevant objects. Intellectual vision functions like sensible vision. In the physical order, if I see too many things at one time, I see them confusedly. For, in order to see them clearly and distinctly, I must concentrate on only a few things at one time.²⁴ The same conditions prevail for intuition. We must learn how to employ our mental faculty of sight in the same way as we employ our eyes. If we focus our attention on a multitude of objects we become confused and cannot see them distinctly. Therefore, we cannot allow ourselves to become distracted by various objects, but must attend to the simple constitutive elements that we judge to be true.²⁵ It is a question of restricting our attention to the relevant evidence present to the mind. Thus, I come to have an intuition of the essence of the wax which is "bien claire & distincte, comme elle est a present, selon mon attention se porte plus ou moins aux choses qui sont en elle, & dont elle est composee."²⁶ My present attention is then the necessary condition for all truth. The general principles and axioms (these include mathematical propositions and ideas such as God and mind) cannot be denied by anyone who regards them attentively.²⁷ When the will obliges the understanding to focus its attention on that which is present, the understanding must affirm the truth of

the evidence. It is not without reason, then, that Descartes was disposed to consider that the highest perfection of man is his ability to act freely or through the will.²⁸

The soul, without restriction, can extend itself to any object in the present. What becomes present in the present is initiated by the will which goads the understanding to attend to the true ideas. The actual evidence is present only in the present, and simultaneous with the presence of the evidence is the affirmation of truth. The present measures the actual existence of the knower, the object known and (simultaneously) the actuality of truth. The existential aspect of intuition cannot be thought of apart from the temporal aspect because actuality is confined to the present time. What is true is always temporally present. This temporal aspect of intuition is clearly brought out by Descartes in Rule Eleven:

Il a fallu proceder ainsi, parce que nous exigeons deux conditions de l'intuition, savoir; que la proposition soit comprise clairement et distinctement, et, de plus, tout entiere dans le meme temps et non successivement.²⁹

One of the features of intuition is its non-successive character. What is comprehended by the mind is grasped in its entirety all at one time. In excluding succession from intuitive thought, Descartes manages to imbue intuition with a certitude that is self-evident in the presence of actual true ideas. With the exclusion of successive time, there is the exclusion of a past that no longer exists and a future

that does not yet exist. And what does not actually exist cannot be seen clearly and distinctly. Descartes gives us examples of those propositions that the understanding intuit. "Chacun peut voir par intuition qu'il existe, qu'il pense, que la figure est unie a l'etendue..."³⁰ It is always in terms of the present tense that Descartes speaks about intuition. The perception of the wax, "laquelle peut etre imparfaite & confuse, comme elle etoit auparavant," can be "bien claire & distincte, comme elle est a present."³¹

Contrary to some historians who contend that intuition takes place in nontemporal, discontinuous instants,³² intuition takes place in a present that has duration. Intuition is an event, and all events are characterized as indivisible units from beginning to end. As indivisible units, events can be distinguished from other events. The Civil War is an historical event that is distinct and other than the historical event of the American Revolution. Both of these events are indivisible units although the time they started was before the time when they finished. Moreover, each of the events has its own extended duration. Similarly, intuition is a mental event that has some duration to it.

When Descartes characterizes intuition as non-successive, we are to understand it in the following manner: If I am presently moving my arm at the same time that I am walking and not successively, for Descartes this means that I did not move my arm before I started walking. It does not

mean that no time had passed while I performed these two actions. However, if I think of one thing (A) and then (B), I have not thought of them at the same time, but successively. I thought of (A) before (B) and of (B) after (A). Just so, if I understand one thing as a whole, that is, no understanding of part (A) before my understanding of part (B), and of the whole (AB) after understanding (B), this does not mean that the time span did not begin before it ended. Nor does it mean that there was no time span from when I began and when I finished. It means that I did not understand one part before and then another part afterwards.

Thus, while time as a property of all events is fundamentally successive, there is also a simultaneous aspect to it in which things are said to coexist at the same time. The perfect example of that simultaneity is in the intuition of the primary truth, the "cogito". One of the conditions for intuition is that the proposition is known entirely all at once. Descartes adheres to this condition in the case of the primary truth. Descartes stresses the point that he who says "ego cogito, ergo sum" does not deduce existence from thinking by means of a syllogism, rather it is known by a "simplici mentis intuitu".³³ It is not a work of reasoning by which I first know the proposition I think and then I know the proposition I exist. "Je pense, donc je suis" is "une connaissance intuitive" known entirely and all at once per se.³⁴ At the same time I conceive the necessary

simultaneity between my thinking and my existence. This truth is apprehended by a simple act of mental vision without any lapse of time.

While the "cogito" is a psychological event, it is at the same time an intellectual event. The knowledge of self is known with more truth and certainty than is the wax, also more clearly and distinctly.³⁵ The notion of the soul arises from an inner experience of one's own thought. Its certitude, however, goes beyond the perimeters of an individual subjective experience. "L'ame ne se concoit que par l'entendement pur", a primitive notion known per se.³⁶ The nature of spiritual substances is to think, yet not all thought is pure intellection. Descartes makes the distinction between direct thoughts such as the simple thoughts of infants which are the feelings of pain, and the reflective thoughts which occur when an adult feels something and simultaneously perceives that he has not felt it before. This latter perception, Descartes says, "je l'appelle reflexion et je la rapporte a l'entendement seul."³⁷

Reflection, as an attribute of pure intellection, is integral to the intuitive process. The understanding needs "une reflexion et attention particuliere" focused on the objects present to it.³⁸ The objects are only mediately seen as the mind sees itself. Intuition calls for a "la reflexion de l'entendement sur lui meme": and looking at itself, the mind sees the actual evidence that must be

affirmed.³⁹ The term "reflexion" is appropriate since Descartes identifies the mind as "intuitus mentis" ou "la lumiere naturelle".⁴⁰ In the physical order reflection is the return of light waves from a surface. In the spiritual order reflection is the mind turning back on itself to see what is simultaneously existing within the mind itself. This reflection illuminates what is present to the understanding, and that illumination is nothing more than "une connoissance intuitive" or a "simplici mentis intuitu" of the truth of the object present to the "la lumiere naturelle."

In the moment of intuition there is the triple affirmation of the actuality of the soul's existence, the existence of the object present, and the existence of truth. To exist, for Descartes, is to endure, and that duration is measured by time.⁴¹ Insofar as the duration of something is actual, it is measured by a 'present' that envelops some duration. Simultaneous with the reflection of the mind on itself is its affirmation of the soul's existence by which the soul comes into contact with its own temporality. In its act of thinking the soul necessarily affirms the self-evidence of its own existence since the substance only becomes aware of itself through its actions.

As the noetic foundation for all truth, the knower is always implicitly aware of his own temporality. The soul always thinks, and in the very moment of thinking there is no thought in us of which the soul fails to be actually conscious.⁴² Consciousness is not simply a psychological

event; as an instance of pure intellection it has noetic implications:

Etre conscient, c'est assurément penser et reflechir sur sa pensee,...et toutes les fois qu'il lui plait reflechir sur ses pensees, ainsi, etre consciente de sa pensee.⁴³

The consciousness of one's own thought as an instance of pure intellection implicitly contains the consciousness of the substance as the subject of actions.⁴⁴ Hence, the consciousness of oneself is integral to the conscious reflection on one's thought and is, in itself, an instance of pure intellection. Further, in the awareness of the substance's existence as the subject of actions, there is always contained the awareness of one's own temporality since all actions have a temporal dimension to them. It is, in fact, the temporal durative aspect of thought that Descartes insists on in his letter to Burman:

Il est faux aussi qu'une pensee se fasse en un instant, puisque toutes mes actions se font dans le temps, et on peut dire que je continue et persevere dans la meme pensee pendant un certain temps.⁴⁵

One of these actions is the intuition of the soul's own existence.

In the Cartesian metaphysics the soul's temporality can be seen by a single mental intuition. "Je pense, donc je suis" constitutes the primary truth from which all other truths can be deduced.⁴⁶ The primary truth is essentially a proposition about temporal existence. That proposition is not only a psychological event, it is raised to the level of

pure intellection as a "simplici mentis intuitu" seen by the "lumiere naturelle" (cf. ftn. #33). The intuition of my own existence is an awareness of my existence in time. "Je suis, j'existe est necessairement vraie, toutes les fois que je la prononce, ou que je la conçois en mon esprit."⁴⁷ That proposition is seen in its entirety all at once. And the thought by which I see the necessary simultaneity of my thought and of my existence is an action that takes place in time. It is an action in which I can continue to persevere.

While my past existence can only be inferred through recollection and my future existence is in doubt, my present existence is certain every time I presently pronounce or conceive it. The thought by which I know myself as presently existing envelops some duration, "je peut dire que je continue et persevere dans la meme pendant un certain temps."⁴⁸ As I persevere in my thought and am conscious of my thought I, as the subject of this mental action, continue to persevere. I am always being "conserve presentement" in existence.⁴⁹

In the order of discovery the Cogito forms the foundation for all other truths. It is my present existence that conditions all intuitional acts. In the intuition of that first truth we find the primary instance of what Descartes means by intuition and the temporal character that attaches itself to intuition. The present awareness of the empirical temporality of the self is, at the same time, the affirmation

of the temporality of thought. Intuition is not conditioned by a discontinuous, durationless moment. All intuition takes place in a present enduring moment that forms an unbroken continuity with other moments. The Cogito, or the primary intuition, is a perfect example of this.

The Cogito is not an isolated thought absolutely independent of all other thought. While Descartes declares that the Cogito is not a result of syllogistic reasoning, he admits that the Cogito implies and is contingent on previously known notions:

Je pense donc je suis, est la premier & la plus certaine qui se present a celui qui conduit ses pensees par ordre, je n'ai pour cela ni qu'il ne fallut savoir auparavant ce que c'est que pense, certitude, existence et que pour penser il faut etre & autre choses semblables.⁵⁰

Moreover, the Cogito has a discursive aspect to it. Descartes unequivocally maintains that this primary intuition is an inference that presupposes a premise:

Avant cette conclusion: je pense, donc je suis, on peut avoir connaissance de cette majeur: tout ce qui pense est, parce qu'en realite elle est anterieure a ma conclusion et que ma conclusion s'appui sur elle...Mais je n'ai pas toujours une connaissance expresse et explicite de cette anteriorite, et j'ai connaissance auparavant de ma conclusion, parce que je ne fais attention qu'a dont j'ai l'experience en moi meme savoir; je pense, donc je suis tandis que je ne fais pas aussi bien attention a cette notion generale: tout ce qui pense est; en effet, comme j'en ai averti, nous ne separons pas ces propositions des choses singulieres, mais nous les considerons en elles.⁵¹

There is no express and explicit appreciation of the temporal distance of the major premise because it is implicit and integrated into the present intuition. As the above two

texts demonstrate, the Cogito is constituted by, and an outgrowth of, elements that are distinct, though inseparable from the present intuition.

Intuition is an instance of present conscious thinking.

Here is what Descartes says about consciousness:

Etre consciente c'est assurément penser et reflechir sur sa pensee, mais que cela ne puisse se faire tant que subsiste la pensee precedente, c'est faux parce que, comme nous l'avons deja vu, l'ame peut penser plusieurs choses en meme temps, perseverer dans sa pensee, et toutes les fois qu'il lui plait reflechir sur ses pensees, ainsi, etre consciente de sa pensee.⁵²

The Cogito is the ultimate manifestation of what it means to be conscious since it is the consciousness of one's own existence. That conscious thought involves reflection that takes in several elements which are retained in the present field of consciousness. As Beyssade and C. Troisfontaines rightly observe, the Cogito is a collection of simple truths and the Cogito would lose its present evidence if one separated it from its reasons.⁵³

The reflective nature of intuition demands a present field of consciousness that includes the immediate past. At the same time it is apparent that present consciousness extends itself to include the immediate future. Two thoughts come together in the intuition, "je pense" and "je suis". The "je suis" must be anticipated in order to form a single simple proposition that first enunciates the "je pense" before (donc) the "je suis". The cognitive operations of retention and anticipation coalesce in the present which contains the two temporal modalities of the immediate past

and immediate future. Each of the present moments can only be conceived as an enduring moment that is perpetually and necessarily connected with the other moments to form an unbroken continuity. To be aware that "je suis" is to be aware that I exist in time, and time, for Descartes, is continuous.

The edifice of science is built on truth that remains eternal. Yet the mental events by which the knower comes to see these truths are temporal. These temporal events constitute the highest expressions of the essential nature of the thinking substance whose duration is qualitatively measured by a 'present' in which the truth is seen. However, these present intuitions form but one link in the long chain of reasoning that culminates in an ordered nexus of intuitions. Reason is a dynamic operational principle which brings various intuitions together in a single, all-inclusive intuition. In the deductive operation we are confronted with another way in which the thinking substance manifests its own temporality as an agent of knowing.

B. Deduction as Durational

There are only a few pure and simple facts that are known per se, all the others are deduced from them either immediately or proximately.⁵⁴ There is a psychological factor in the inferential process, the movement of the mind:

La deduction...ne parait pas se faire tout entiere dans le meme temps, mais elle implique un certain mouvement de notre esprit.⁵⁵

Descartes provides an example of simple deduction: 2 and 2 equal 3 and 1, 2 and 2 equal 4, therefore 3 and 1 equal 4.⁵⁶

As it turns out, however, deduction is not always as simple as deducing a few terms. More often it is complex and involved, and receives the name of enumeration.⁵⁷ In the process of enumeration the mind repeats the steps already deduced. This accomplishes three goals.

First of all, there is the ultimate goal to arrive at a certain and indubitable knowledge:

Pour achever la science, il faut parcourir par un mouvement continu et ininterrompu de la pensee toutes les choses qui se rapportent a notre but et chacun d'elles en particulier, ainsi que les embrasser dans une enumeration suffisante et ordonne.⁵⁸

Secondly, in complex cases where the conclusion is remote we might have to rely on memory to remember the first and intermediate steps. However, memory is weak and liable to fail;⁵⁹ therefore, we must reduce our dependence on memory by reviewing the steps repeatedly through a rapid movement of the mind. This second goal of enumeration, diminishing the role of memory, is conjoined to the third goal of enumeration as a temporal event: namely, to see the series as a whole at one time.⁶⁰ In essence, it is an attempt to reduce the time factor so that what was once apprehended successively is now apprehended simultaneously.

Descartes provides instructions for the mind to follow in applying the enumeration method:

Par exemple, si j'ai reconnu tout d'abord par différentes opérations quel rapport il y a entre les grandeurs A et B, ensuite entre B et C, puis entre C et D, et enfin entre D et E, je ne vois pas pour cela quel rapport il y a entre A et E, et je ne peux pas l'apercevoir d'après ceux qui sont déjà connus, à moins de me les rappeler tous. Ainsi je les parcourrai plusieurs fois d'un mouvement continu de l'imagination qui, dans le même temps, doit avoir l'intuition de chaque chose et passer à d'autres jusqu'à ce que j'aie appris à passer du premier au dernier assez rapidement pour ne laisser presque aucun rôle à la mémoire et avoir, semble-t-il, l'intuition de tout à la fois, on corrige aussi la lenteur de l'esprit et d'une certaine manière on étend sa capacité.⁶¹

The purpose of enumeration is not to acquire new premises or to infer anything new from previously acquired premises. It is a method of reviewing and repeating what has already been deduced. The repetitive process merely facilitates and strengthens the memory.

C'est qu'en effet la mémoire, dont nous avons dit que dépend la certitude des conclusions qui comprennent plus de choses que nous n'en pouvons saisir en une seule intuition, étant fugitive et faible, il faut la rafraîchir et l'affermir par ce mouvement continu et répété de la pensée.⁶²

Two points are worth noting. In the first place, it is apparent that Descartes never believed one could totally eliminate the role of memory in a deductive process that was heterogeneous and complicated. Although he acknowledged its weakness, nevertheless he proposed that memory could be strengthened so that, nothing being forgotten, we would seem to have a vision of the whole all at one time. The repetitive process, then, brings longer and longer sections of the deduction chain within intuitional grasp. I must run over

the steps so rapidly that there is nothing that falls out of the range of the present intuition and the whole seems to be grasped all together at one time.

By the faculty of memory we distinguish past time, that which was formerly or 'before'. If we read the texts closely, we see that Descartes recognizes two decidedly different functions of memory, that of remembering and that of retaining. Concomitant with the act of remembering, one recognizes that the remembered object was perceived 'before' and that it is now being perceived anew again.⁶³ According to this view of Descartes', to remember something is to re-present a 'before' that has slipped out of consciousness because of an intrinsically feeble memory.

The goal of enumeration is not to eliminate the role of memory but to shift the role of memory from its function of remembering to its function of retaining. The faculty of memory perceives the 'before' as either remote or proximate. When the 'before' has vanished from consciousness and must be remembered or re-presented it may be said to be remote since it is removed in time from the present. The 'before' is proximate when it is integrated into the present consciousness by the memory which retains what has gone before. Enumeration serves to transpose the remote 'before' into the proximate 'before' so that the remote 'before' as an object to be remembered becomes the proximate 'before' which is retained by memory as a part of present consciousness. The 'before' that is retained is not re-presented, it

is 'present' in the mental field of present consciousness.

As we have seen, what is demanded in enumeration is "un certain mouvement de la pensee, qui voit chaque chose en meme temps par une intuition attentive et qui passe aux autres."⁶⁴ The thread of continuity on which the certitude of the conclusion is premised can only be unbroken if the antecedent falls within the range of the present span of consciousness. Here the role of memory as retainer comes into operation. Concerning enumeration, Descartes holds that "sa certitude depend dans une certain mesure de la memoire, qui doit retenir les jugements, portes sur chacun des points enumeres pour tirer d'eux tous un jugement unique."⁶⁵ As Descartes clearly indicates, the role of memory is not to remember or re-present a remote 'before' that has slipped out of consciousness. The process of enumeration serves to strengthen the memory so that it can retain the proximate 'before' "as present" within the intuitional grasp. Hence, Descartes counts "la memoire aussi ample au aussi present" as one of the indispensable qualities which serve to perfect the mind.⁶⁶

Enumeration has a deductive and intuitive aspect to it. Insofar as enumeration demands an uninterrupted movement from one proposition to another, it is deduction. Insofar as the deduction forms a series of self-evident propositions that are apprehended intuitively, it is intuition.⁶⁷ One point of view stresses the immediacy and self-evidency of

each of the propositions, and the other stresses the inferential aspect. The successive movement of the mind always encompasses an integration of present intuitions because each of the intuitions always includes its antecedents retained by the memory.

A necessary adjunct to that memory is the will which determines those objects to be retained and those to be excluded from the present intuition:

Une pluralite d'objets ne peut aider l'entendement a avoir l'intuition distincte de chaque chose. Mais pour extraire quelque chose d'une pluralite d'objets, ce qu'il faut souvent faire, il faudra retrancher des idees qu'on a des choses tout ce que n'exigera pas l'attention du moment, afin que le reste puisse etre plus facilement garde dans la memoire.⁶⁸

The inferential process is not an arbitrary compilation of random facts. The selectivity of objects to be retained in the present field of attention is logically determined by what has preceded it in the chain of reasoning. The key to the Cartesian method is order.

Turning to mathematics as the ideal science, Descartes finds that the secret of mathematics resides in order. Primarily, mathematics is concerned with proportions or relations between things and the order in which they are arranged and deduced from one another.⁶⁹ Attempting to reach the same degree of clarity and cognitive force that characterize mathematics, Descartes applies the mathematical method of order as the principal ingredient in his own method:

Toute la methode consiste dans l'ordre et la disposition des choses vers lesquelles il faut tourner le regard de l'esprit, pour decouvrir quelque verite. Or nous la suivrons exactement, si nous ramenons graduellement les propositions compliquees et obscures aux plus simples, et si ensuite, partant de l'intuition des plus simples, nous essayons de nous elever par les memes degres a la connaissance de toutes les autres.⁷⁰

As a reviewing process enumeration functions to strengthen the retentive power of memory. However, because the mind can have several things before it at the same time it is important to direct the flow of ideas and retain only those that contribute to a logically ordered nexus of truths.⁷¹ There is a necessary link between the antecedent and consequent. They so depend on one another that it is impossible for either to change while the other remains unchanged.⁷² The necessary interdependency means that the deduction of a single fact is conditioned by a number of other facts that involve one another. The conclusion is no more certain than the premises. Hence, if the logical sequential order is subverted or a link of the chain is omitted, the certitude of the conclusion is threatened.⁷³

Since the goal of enumeration as a form of deduction is to intuit the whole as a synthesis of necessarily connected terms, the inclusion of every term is vital. The point of beginning and the point of ending is intuition, and each of the steps within the serial intuition is itself an intuition necessarily linked to its neighbor. One of the characteristic features of enumeration is the immediacy and self-evidency

contained in each of the intuitions. The intellectual illation logically constitutes an uninterrupted sequence of self-evident data in which the antecedent is contained in the consequent being presently intuited. While each intuition contains the antecedent, it does not contain it as a 'before' that no longer exists. The antecedent is retained "as present" within the present span of attention.

Each term in the process is simultaneously both an antecedent and a consequent since each is related to the term 'before' and the term 'after'. However, insofar as the antecedent and consequent are contained in the present there is, in truth, no past which has ceased to exist and no future which is yet to exist. There is only the all-inclusive present. The temporal goal of enumeration is to reduce the time-span and to ideally bring the succession to a quasi-simultaneity where the whole seems to be grasped all at once. The time is diminished in proportion to the extension of the present span of attention. The repetitive process facilitates the reduction of the time as the memory is strengthened to retain more and more objects in the present range of attention. Enumeration is the prescription which remedies the deficiencies of memory and contributes to extending the amplitude of the mental field of attention:

Après que nous avons eu l'intuition de quelques propositions simples, si nous en deduisons quelque autre, il est utile de les parcourir toutes d'un mouvement de pensée continue et ininterrompu, de réfléchir à leurs relations, et, autant que cela est possible de concevoir distinctement plusieurs choses à la fois.⁷⁴

There are three salient points contained in the passage. The first is that the thread of continuity cannot be broken by an interrupted movement. This presumes that there is a constituted fusion or unity between the diverse mental acts. Secondly, the unity is the creation of the understanding via the attentive reflection of the mind. The latter, at the same time, sees both the relation between the antecedent and consequent as well as the distinction between them. Thirdly, the time span of the intuition must be long enough to allow the mind to reflect on the distinction and the bonds that mutually relate the two propositions. The time required must be long enough "a reflechir avec sagacite aux moindres choses que l'on a precedemment percues."⁷⁵ The attention that Descartes prescribes is equivalent to a "mediation attentive" on what has been retained in the memory, "il faut moins les retenir par la memoire que les distinguer par penetration d'esprit."⁷⁶

Descartes' first dictate in Rule IX is to perform the inferential process so that the movement of the mind is uninterrupted. Movement of even the thinking substance can generally be conceived as an action or activity. In the case of enumeration, the action is one of concatenated reasoning which synthesizes the separate mental acts into a unity when the thinking substance perceives the binding essential relationship between the implicitly distinct terms. Enumeration is a repeated process. First, I find out by a

single intuition the relation between A and B, then B and C, then C and D and then D and E. Then I run over all of these several times in a continuous and uninterrupted movement so that ultimately I see the relation between A and E. It is possible to do this because, as I run over all of the single intuitions I have "dans le meme temps...l'intuition de chaque chose et passer d'autres" until I have "l'intuition de tout a la fois."⁷⁷ The continuity and rapidity of the movement enables the mind to keep within the present attention-range all the antecedents and consequents. In the ultimate intuition where one sees the relation between A and E, four separate mental acts come together simultaneously.

No doubt, as Descartes admits, while we can view more than one thing at a time, we cannot view a multitude of particular things at the same time.⁷⁸ Just as the eye is unable to distinguish a multitude of objects at the same time, neither is the mind able to distinguish a multitude of things. However, through an effort of attentive reflection, the mind with its limited field of consciousness can apprehend simultaneously several ideas such as some simple premises and their immediate consequences. There is the mental field that makes it possible to transpose a plurality into a unity wherein four acts of thought come together simultaneously. The mental field is manifested when the mind attends to and grasps both the antecedent and consequent. At the same time that the mind is attending to one thing, it is reflecting

on "lien qui unit chacun d'eux a ses voisins, cela suffira pour que nous disions aussi que nous avons vu comment le dernier est lie au premiere."⁷⁹

Enumeration strengthens the power of the mind to expand that limited mental field of attention so that it can encompass as many things as possible at the same time.⁸⁰ By the distention of consciousness the attentive mind bridges the gap from one term to another. Each time the mind repeats the enumeration process more and more things are seen simultaneously. The discrete intuitions which were originally intuited as a successive series of terms ordered one to another as 'before' and 'after' respectively, past and future, are ultimately integrated into the present intuition that grasps the whole at one time.


That terminal intuition is analogous to the perception of a continuous magnitude in which there are no actual parts, yet which always implicitly contains potential parts. The parts are subsumed by the whole through a process of synthesis. If we look at how the imagination functions in the perception of a magnitude we come to a clearer idea of the dynamics of the process of synthesis effected by the understanding. There are two reasons that justify using the comparison. First of all, imagination is a mental action included under the category of thought. Secondly, there is Descartes' thinking regarding the use of mathematical symbols. It is possible, Descartes maintains, that when we

are attempting to understand proportions or relationships between things, regardless of the subject matter, we can use geometric figures to aid us in understanding the unity that exists between things.⁸¹

The unity that is effected in the simultaneous intuition of the whole has a correspondent operation in mathematics. That operation is addition. In addition we add one part to another until eventually we reach the whole. In addition, we can conceive the subject under the form of a line so that we add one segment to another until we reach the whole that is now perceived as a continuous magnitude.⁸² Addition is fundamentally a process of synthesis effected by the imagination which creates the continuous magnitude by uniting one segment to the other.⁸³ Visually, that synthesis is demonstrated in the following manner:

First we consider the segment (a) ' ' ' ' ' ' then

(b) ' ' ' ' ' ' .

Then we join (a) to (b)  .

And we obtain (c) ' ' ' ' ' ' ' ' ' ' ' ' .

In the original perception (a) and (b) were ordered to each other as 'before' and 'after'. First I consider (a) then (b), that is, I consider them successively. As the imagination moves along, it bridges the span and the order is dissolved. (a) and (b) are no longer perceived as distinct successive segments but are joined to form (c), a continuous magnitude that implicitly contains (a) and (b). In the

perception of that magnitude there is no longer the question of position or order of parts since there are no actual parts. (a) and (b) exist simultaneously as (c) _____. The succession is reduced to simultaneity.

What is present to the imagination is an unbroken line which is the product of its own inventive effort. That same imaginative power of the mind can make present what is not, in itself, actually present. The triangle that I see with my mind's eye is not present. Rather, "je considere ces trois lignes comme present par la force & application interieure de mon esprit."⁸⁴ The triangle is made present through the medium of the imaginative power. As the imagination makes the triangle present to the mind, similarly, the imagination also makes present a continuous magnitude, a whole without parts. This is done through a synthetic operation.

In deduction we find an analogous case. The order in deduction comprises a nexus. This synthesis of all the discrete mental operations that form the chain of concatenated reasoning can only be effected through the meditative effort of attention. The simultaneous intuition of the whole is conditioned by a mental field of consciousness which joins all of the antecedents and consequents in the chain. The mind must have before it 'as present' the antecedents and consequents which are continuously being integrated just as the imagination, in the process of addition, has present before it the parts that it adds to form the continuous magnitude.

Insofar as the antecedents and consequents were originally discrete mental operations, they were formed into a successive series in which each of the terms was related to the other as 'before' or 'after'. From the temporal dimension their position in the long chain of reasoning could be conceived as past or future. Once the antecedent had been intuited it became past, and the consequent yet to be intuited was, in respect of that antecedent, future. The ultimate intuition, however, does not view the antecedents and consequents as 'before' or 'after'. As that order is dissolved, so, too, is the past and future as 'past' and 'future'. The past and future are integrated and contained in a field of presence.

Through a synthetic operation the antecedents and consequents, the past and future, are continuously being integrated into the present intuition. Each time that the enumeration process is repeated, the antecedents and the consequents' 'presence' in the present becomes more pronounced. Hence, in the ultimate intuition whereby the mind sees the relationship between A and E, the terms in the long chain of reasoning are so 'present' that no longer is the repetitive process necessary. The culmination of the process, the intuition of an organic whole, presupposes that the field of attention has been expanded so that it can encompass all of the terms at one time. No link in the chain is outside of the present range of attention.

We were able to see how the synthetic operation was manifested in the process of addition whereby the segments were added together to form an unbroken whole perceived as an extended line. The perception of a melody provides another example of the dynamics of the process of deduction. There is a striking resemblance between the operation integral to deduction and that found in the perception of a melody. Both in the case of deduction and in the perception of a melody, it is always a question of integrating parts to form a cohesive whole. Descartes' treatise on music illustrates how the synthetic operation results in the perception of a melody as a whole.

The basis of music is sound and the attributes of sound are primarily two: its differences of duration or time and its differences of tension from high to low.⁸⁵ Hence, we are dealing with relations and proportions between things, and this is exactly what the mathematician treats. There is a basis of similarity between the hearing of a melody and the process of deduction. First of all, in both cases there cannot be a multitude of objects in question. When it comes to the hearing of sounds there cannot be a profusion of sounds which would fall on the senses in too complicated or too confused a fashion so that the melody could not be distinctly perceived.⁸⁶ Analogously we know that in deduction the mind can see distinctly only a few objects at one time; a multitude of objects would cause

confusion and ambiguity.⁸⁷

The second point of similarity is that in a melody the perception of a pure and simple consonance depends not only upon the qualities of each simple unit, but also upon the resonance of all the component elements together.⁸⁸ This corresponds to what Descartes says in the Rules regarding deduction. If we know the consequent, a simple unit, we necessarily know the antecedent, another simple unit. Since there is an essential connection between the two, the antecedent is always implicitly contained in the consequent.⁸⁹

The third point of similarity is that in a melody the quality of consonance of the entire melody depends on the correct order of musical tones.⁹⁰ Certainly we know that the secret of the Cartesian method of deduction consists wholly in the order and disposition of things upon which the certitude of the conclusion depends.⁹¹

Finally, it must be said that music is a science of movements insofar as the basis of music is sound, while one of the attributes of sound is the difference of duration or time, the measure of motion. Moreover, the ear perceives these movements, and "moves" along with the sounds and integrates them so that they form a unity. Analogously, in deduction the mind moves along, always perceiving with the mind's eye the antecedent and its necessary connection with the consequent, until it finally sees them all as a cohesive whole. In attending to these similarities between deduction

and the perception of a melody, we might take note that in both cases a synthetic operation condenses the moments. We are familiar with what Descartes has to say about deduction (cf. ftn. #61). Here is the passage from the Compendium in which Descartes speaks about the proportion of time in sound:

Or cette proportion est souvent gardee avec tant d'exactitude dans les membres d'une chanson qu'entendant encore la fin d'un temps, nous nous ressouvenons par son moyen du commencement et de la suite de la meme chanson...car alors ayant entendu les deux premiers membres, nous les concevons comme un seul; ayant entendu le troisieme, nous le joignons avec les deux premieres, en sorte que la proportion est triple: lorsque nous entendons le quatrieme, nous le joignons au troisieme, et de ces deux derniers nous n'en faisons qu'un; puis joignant les deux premiers aux deux derniers, on concevra ces quatre membres ensemble comme un seul, et c'est ainsi que notre imagination se conduit jusques a la fin; ou elle se represente toute la chanson comme un corps entier compose de plusieurs membres.⁹²

At the same time that we are hearing one melodic phrase, we are retaining what has preceded and are anticipating what is to follow so that we are continuously integrating the phrases and thus perceiving the melody as a whole. If there was a rupture between our perception of the melodic phrases, the proportion necessary for the hearing of this particular melody would no longer be present. Since it is the time-values or the proportions in time that, in part, determine how the melody is perceived, a continuous movement of the imagination is required. This movement is the integration of the preceding and following phrases in the present phrase now being perceived. The preceding and

following phrases are coalesced in the present melodic phrase so that, in effect, no phrase that constitutes the melody as a whole is ever past or future in the sense that it no longer exists or does not yet exist. As phrases of a melody, like the months of a year, the phrases of a melody exist simultaneously as a whole. The phrases are not prior in time but are perceived simultaneously with the melody. It is the movement of the imagination that makes this possible as it continuously perceives 'as present' what has preceded and what follows the present perception. The 'presentification' of all of the melodic phrases makes it possible to experience the pleasure that comes from hearing the melody as a whole.

Analogously, as the understanding moves from one link in the chain to another, it stretches itself out to include what immediately precedes and what immediately follows. Just as a rupture between the melodic phrases would degrade the intended melodic effect, similarly in deduction any interruption in the movement of the mind would threaten the certitude since it would be possible to omit a necessary link in the chain. In the hearing of a melody there must be a field of perception that can make "comme present" the 'before' and 'after' so that the melody is perceived as an undivided unity from beginning to end. This is also true of the mental field of consciousness necessary in deduction. The amplitude of that "field of presence" must be wide

enough to attend, at the same time, to both the antecedent and the consequent as it moves along. Through the repetition of the movement the chain of successive links becomes shorter and shorter until the whole series is condensed into the present intuition wherein the separate links no longer are viewed as discrete parts related to each in an order of 'before' and 'after'. The ultimate intuition of the whole is an event in which the parts exist simultaneously as an undivided unity.

In the reduction of the succession to simultaneity, the temporal aim of deduction is accomplished. The 'before' and 'after' as past and future become integrated into the present where all of the parts co-exist at the same time. That temporal effect is made possible because the duration of the thinking substance, although successive in nature, is continuous.⁹³ While the continuous duration is potentially divisible into moments of 'before' and 'after', actually it is an unbroken unity in which the past and future are always integrated as present parts into the present whole. In light of Descartes' prescribed rules for deduction, it would seem logically false to assert that time, for Descartes, is discontinuous. For it is only through "un mouvement de pensee continu et ininterrompu" that we can eventually have an intuition of the whole "a la fois."

C. The Permanent Self as Durational

Deduction manifests the epistemic power of the thinking substance as an organizing consciousness whose actions take place in time. The temporal duration of the thinking substance is projected as a multiplicity of successive mental events. However, the unification of facts and the development of science imply a ground of permanence that makes possible the unity. As the noetic foundation of Descartes' science, the thinking substance must have ontological status as a permanent substance whose substantial identity is preserved in time. Without that status science as a developmental intellectual event becomes unthinkable.

The Cartesian doctrine of method ontologically suggests that the life of the mind is a succession of epistemic events. Yet, there is a permanent self that transcends the dispersion of the moments because it is that which enjoins the intuitions and reduces them by deduction to a single vision. The soul remains ontologically the same throughout its durational actions. "Car encore que tous ses accidents se changent, par exemple, qu'elle conçoit de certaines choses, qu'elle en veuille d'autres, qu'elle en sente autres, &, c'est pourtant toujours la meme ame."⁹⁴

While Descartes recognizes the de facto unity of mind and body nevertheless, the body is essentially and radically distinct from the soul, and the numerical unity of the substance as a concrete person resides in "sa forme que est

l'ame."⁹⁵ Although the numerical unity of the substance resides in the form of the soul, Descartes ascribes to that soul no principle of auto-continuation by which it can account for its own permanence:

Si j'avoir la puissance de me conserver moi meme j'aurois aussi a plus sorte raison, le pouvoir de me donner toutes les perfections qui me manquent, car ces perfections ne sont que des attributs de la substance, & moi je suis une substance. Mais je n'ai pas la puissance de me donner toutes ces perfections; car autrement je les possederai. Doncques je n'ai pas la puissance de me conserver moi meme.⁹⁶

Since the substance lacks an intrinsic power of conservation Descartes must appeal to a transcendental ground of unity. It is a recognition of the substance's inability to account for its continuance in existence that provides Descartes with his second proof for the existence of God. Utilizing the infinite regress argument (which is fundamentally one of vertical regression that seeks a cause of existence in each moment), Descartes posits God as the cause which conserves the substance in being:

Car, tout de meme que, bien que j'eusse ete de toute eternite, et que par consequent il n'y eut rien eu avant moi, neanmoins, parce que je vois que les parties du temps peuvent etre separees les unes d'avec les autres et qu'ainsi, de ce que je suis maintenant, il ne s'ensuit pas que je doive etre encore apres, si, pour ainsi parler je ne suis cree de nouveau a chaque moment par quelque cause, je ferais point difficulte d'appeler efficiente la cause qui me cree continuellement en cette facon, c'est-a-dire me conserve.⁹⁷

In the case of substances and their relation to God, it is not only a question of their production, it is a question of their conservation in existence as the same self. Descartes

demonstrates the relation between God and created substances as analogous to the relation between the sun and the light which proceeds from it. Drawing on that analogy, Descartes proposes that

[L]'architecture est la cause de la maison, et la pere la cause de son fils, quant a la production seulement; mais le soleil est la cause de la lumiere qui procede de lui, et Dieu est la cause de toutes les choses crees, non seulement en ce qui depend de leur production, mais meme in ce qui concerne leur conservation ou leur duree dans l'etre. C'est pourquoi il doit toujours agir sur son effet d'une meme facon pour le conserver dans le premier etat qu'il lui a donne.⁹⁸

Descartes persists in the analogy:

Il est bien plus certain qu'aucune chose ne peut exister sans le concours de Dieu, qu'il n'est certain qu'aucune lumiere du soleil ne peut exister sans le soleil. Et il n'est pas douteux que si Dieu arretait son concours aussitot toutes les choses qu'il a crees retourneraient au neant, parce que, avant qu'elles ne fussent crees et qu'il ne leur pretat son concourse, elles n'etaient rien.⁹⁹

The analogy signals the radical finitude of the thinking substance. Yet the analogy has a positive aspect to it. God is "la source de toute lumiere", and in creating and conserving the thinking substance, God simultaneously creates and conserves the "faculte de connaitre" that "nous appelons lumiere naturelle".¹⁰⁰ The Cartesian doctrine of method shows how the thinking substance can "accroitre la lumiere naturelle de sa raison,"¹⁰¹ and thereby achieve the certitude that is demanded in science.

The appreciation of knowledge is effected by a knower in time. Aware of the brevity of the duration of the thinking substance, Descartes, nevertheless, believed that

the thinking substance was endowed with a noetic faculty, which, if used in accordance with the prescribed method, could acquire some knowledge of nature.¹⁰² Although the progress achieved by the thinking substance is constituted by a succession of mental events, the thinking substance as an agent of knowing retains its substantial identity throughout the successive duration of its life. That permanence, albeit guaranteed by God, is the noetic condition for science as an ongoing event. For science constitutes the ultimate goal of the thinking substance as an agent of knowing and the agent's duration, like the duration of all substances, is measured by time.¹⁰³

NOTES - CHAPTER IV

¹Regle XII, Pleiade, p. 75; Princip. I, 60, A.T. IX, p. 57.

²Discourse, A.T. VI, p. 62. "...thus we can render ourselves masters and possessors of nature."

³Resp. III, A.T. IX, p. 137; Med. A.T. XI, p. 29; "...the subject of some actions."

⁴Ent. avec Burman, Pleiade, p. 1338. "...all our actions are made in time."

⁵Med. III, A.T. IX, p. 35; Regle XII, Pleiade, pp. 81-82.

⁶Regle I, Pleiade, p. 38. "...increase the natural light of his reason."

⁷Prin. Pre. A.T. IX, p. 14.

⁸Discourse, A.T. VI, pp. 19-20; Regle IV, Pleiade, p. 50; A Beeckman, 23, April, 1619, A.M. I, p. 14.

⁹Although Descartes never completed his work, there is no evidence its incompleteness testifies to his repudiation of it. Aside from the movement away from a theory of direct realism to one of representation, there seems to be no significant point of discrepancy between this early work of Descartes and his later works. Considering that the methodological doctrine of the Rules was left fundamentally intact there is no reason to discredit it because it was left incomplete. As it stands, it provides us with a clear understanding of the Cartesian method for attaining truth in the sciences. Moreover, certain historians are of the belief that the Rules are simply an elaborated form of the Discourse and contain a more adequate and detailed treatment of the Cartesian method. Cf. Charles Adams, A.T. X, pp. 530-532; L. Beck, The Method of Descartes (Oxford 1952), p. 7; cf. Beck's footnote on the same page in which he cites Milhaud, Boutroux, Meyerson, Brunschvieg, Hamelin, Gibson and Rivaud, all of whom maintain this same opinion. Beck's book may be consulted for an in-depth analysis of the Rules.

¹⁰Regle IV, Pleiade, p. 47; Regle III, Pleiade, p. 43. H.R.I., p. 7. "But lest we in turn should slip into the same error, we shall here take note of all those mental operations by which we are able, wholly without fear of illusion, to arrive at the knowledge of things. Now I admit only two, viz. intuition and deduction." H.R. translates "la deduction" as 'induction'. I have substituted 'deduction' since Descartes in this context uses it in its more narrow sense as a mental process without reference to experiments which would be more appropriately contained under the term 'induction'. The latter would, however, provide the steps that are to be included in the purely cognitive illation process.

¹¹Resp. II, A.T. VII, p. 140. "...I think, therefore I am...a simple mental intuition" (vision).

¹²A Marquis de Newcastle, Mar ou Apr., 1648, A.T. V, p. 136. A Unknown, March, 1637, A.T.I., p. 353; A Mersenne, 16, Oct., 1639, A.T. II, p. 599.

¹³A Mersenne, 16, Oct., 1639, A.T. II, p. 599. "...light of nature or mental intuition." Kenny translates this as the light of nature or eye of the mind. Thus he keeps the metaphoric implication that Descartes intended, p. 67; A Marquis, March ou April, 1648, A.T. V, p. 333; Resp. II, A.T. IX, p. 116; Regle XII, Pleiade, p. 81.

¹⁴Prin. I, 30, A.T. IX, p. 38. "...the faculty of knowledge [that] we call natural light; cf. Med. III, A.T. IX, p. 32; Resp. IV, A.T. IX, p. 184; A Mersenne, 16, Oct., 1639, A.T. II, p. 598.

¹⁵Prin. III, 94, A.T. IX, p. 157.

¹⁶Regle XI, Pleiade, p. 73.

¹⁷Resp. II, A.T. VII, p. 140; Regle III, Pleiade, p. 44; Resp. I, A.T. IX, p. 85; Med. II, A.T. IX, p. 19; Med. III, A.T. IX, p. 35.

¹⁸Regle III, Pleiade, p. 44. H.R. I, p. 7. "By intuition I understand, not the fluctuating testimony of the senses, nor the misleading judgment that proceeds from the blundering constructions of imagination, but the conception which an unclouded and attentive mind gives us so readily and distinctly that we are wholly freed from doubt about that

which we understand... Or, what comes to the same thing, intuition is the undoubting conception of an unclouded and attentive mind, and springs from the light of reason alone; it is more certain than deduction itself in that it is simpler...;" cf. Regle XII, Pleiade, p. 84; Prin. I, 45, A.T. IX, p. 44.

¹⁹Regle XII, Pleiade, p. 84. "The understanding can never be deceived if it restricts itself so as to have the clear intuition of that which is present to it." Cf. A Regius, 24, May, 1640, A.T. III, p. 63; Prin. I, 13, A.T. IX, p. 30; Med. III, A.T. IX, p. 41.

²⁰Regle III, Pleiade, p. 44. "...each can see by intuition that he exists."

²¹Regle XII, Pleiade, p. 76; A Mesland, 2, May, 1644, A.T. IV, p. 113.

²²A Mesland, 2, May, 1644, A.T. IV, p. 113. "...only its volitions are activities." Cf. A Regius, May, 1641, A.T. III, p. 372.

²³A Mersenne, May, 1637, A.T. I, p. 365; Med. II, A.T. IX, p. 22; Med. IV, A.T. IX, p. 68; Resp. II, A.T. IX, p. 137.

²⁴Dioptrique, A.T. VI, p. 163.

²⁵Prin. I, 75, A.T. IX, p. 14; Regle XII, Pleiade, p. 84; Med. V, A.T. IX, pp. 54-55; Regle IX, Pleiade, p. 67.

²⁶Med. II, A.T. IX, p. 25; H.R.I., p. 155. "...clear and distinct as it is at present according as my attention is more or less directed to the elements which are found in it and of which it is composed."

²⁷A Hyperaspistes, August, 1641, Pleiade, p. 1130; Passions 76, A.T. IX, p. 385.

²⁸Prin. I, 37, A.T. IX, p. 40; A Christine, 20, Nov., 1647, A.T. V, p. 85.

²⁹Regle XI, Pleiade, p. 73. H.R.I., p. 33. "It was necessary to do this because two things are requisite for mental intuition. Firstly, the proposition intuited must be clear and distinct; secondly it must be grasped in its totality at the same time and not successively."

³⁰Regle III, Pleiade, p. 44. "Each can see by intuition that he exists, that he thinks, that figure is united to extension."

³¹Med. II, A.T. IX, p. 25. H.R.I., p. 155. "...which can be imperfect and confused as it was formerly...as clear and distinct as it is at present."

³²Gueroult, pp. 98-99; Vigier, p. 230; Wahl, p. 14; Belavel, p. 149. The position of these historians is refuted by the following: La Porte, p. 158; Roger Lefevre, La Bataille du Cogito (Paris 1960), p. 28; Pierre Boutroux, L'Imagination et les Mathematiques Selon Descartes (Paris 1900), pp. 15-16; J. M. Beyssade, pp. 348-349. Claude Troisfontaines, "La Temporalite de la Pensee chez Descartes," Revue Philosophique Louvain, Vol. 87 (1989), pp. 5-22.

³³Resp. II, A.T. VII, p. 140. "...I think, therefore I am...a simple mental intuition." Cf. A Mersenne, 16, Oct., 1639, A.T. II, p. 599.

³⁴Au Marquis de Newcastle, March ou April, 1648, A.T. V, p. 138. "I think therefore I am [is] an intuitive knowledge."

³⁵Med. II, A.T. IX, p. 26.

³⁶A Elizabeth, 26, June, 1643, A.T. III, p. 691. "The soul is conceived only by pure intellect."

³⁷A Arnauld, 29, July, 1648, Pleiade, p. 1307. "I call reflection and relate it to the understanding alone."

³⁸Passions, A.T. IX, p. 385. "...a reflection and particuliar attention..."

³⁹Regle XII, Pleiade, p. 84. "...the reflection of the understanding on itself."

⁴⁰A Mersenne, 16, Oct., 1639, A.T. II, p. 599. "...eye of the mind or the natural light."

⁴¹Prin. I, 62, A.T. IX, p. 53.

⁴²Resp. IV, A.T. IX, p. 190; Resp. VI, A.T. IX, p. 229.

⁴³Ent. avec Burman, Pleiade, p. 1359. Cottingham, p. 7.
 "It is correct that to be aware is both to think and to reflect on one's thought...It has the power to reflect on its thoughts as often as it likes, and to be aware of its thought in this way."

⁴⁴Resp. III, A.T. IX, p. 136.

⁴⁵Ent. avec Burman, Pleiade, p. 1358. Cottingham, p. 6.
 "It is false that thought occurs instantaneously; for all my acts take up time, and I can be said to be continuing and carrying on with the same thought during a period of time."

⁴⁶Discourse, A.T. VI, p. 32.

⁴⁷Med. II, A.T. IX, p. 19. "I am, I exist is necessarily true, all the times that I pronounce it or that I conceive it in my mind."

⁴⁸Ent. avec Burman, Pleiade, p. 1358. "I can be said to be continuing and carrying on with the same thought during a period of time."

⁴⁹Med. III, A.T. IX, p. 40; Resp. I, A.T. IX, p. 85.

⁵⁰Prin. I, 10, A.T. IX, p. 29. "I think, therefore, I am, is the first and most certain [truth] which presents itself to those who think in orderly fashion, I did not for all that deny that it is necessary to previously know what is thought, certitude, existence, and that in order to think it is necessary to exist, and such like."

⁵¹Ent. avec Burman, Pleiade, pp. 1356-1357. Cottingham, p. 4. "Before this inference, 'I think therefore I am', the major 'whatever thinks is' can be known; for it is in reality prior to my inference, and my inference depends on it. This is why this author says in the Principles that the major premise comes first, namely because implicitly it is always presupposed and prior. But it does not follow that I am always expressly and explicitly aware of its priority, or that I know it before my inference. This is because I am attending only to what I experience inside myself—for example, 'I think therefore I am': I do not pay attention in the same way to the general notion 'whatever thinks is'. As I have explained before, we do not separate out these general propositions from the particular instances; rather, it is in the particular instances that we think of them."

⁵²Ent. avec Burman, Pleiade, p. 1359. Cottingham, p. 7. "It is correct that to be aware is both to think and to reflect on one's thought. But it is false that this reflection cannot occur while the previous thought is still there. This is because, as we have already seen, the soul is capable of thinking of more than one thing at the same time, and of continuing with a particular thought which it has. It has the power to reflect on its thoughts as often as it likes, and to be aware of its thought in this way."

⁵³J. Beyssade, p. 237; Troisfontaines, p. 21.

⁵⁴Regle VI, Pleiade, p. 54.

⁵⁵Regle XI, Pleiade, p. 73. H.R.I., p. 32. "As for deduction...it appears not to occur all at the same time, but involves a certain movement [of the mind]."

⁵⁶Regle III, Pleiade, p. 44.

⁵⁷Ibid.; Regle XI, Pleiade, p. 73.

⁵⁸Regle VII, Pleiade, p. 57. H.R.I., p. 19. "If we wish to be complete, those matters which promote the end we have in view must one and all be scrutinized by a movement of thought which is continuous and nowhere interrupted; they must also be included in an enumeration which is both adequate and methodical." Cf. Regle II, Pleiade, p. 39.

⁵⁹Regle XI, Pleiade, p. 73.

⁶⁰Regle VII, Pleiade, p. 58; Regle XI, Pleiade, pp. 72-73.

⁶¹Regle VII, Pleiade, p. 58. H.R.I., p. 19. "Thus, e.g., if I have first found out by separate mental operations what the relation is between the magnitudes A and B, then what between B and C, between C and D, and finally between D and E, that does not entail my seeing what the relation is between A and E nor can the truths previously learnt give me a precise knowledge of it unless I recall them all. To remedy this I would run them over from time to time keeping the imagination moving continuously in such a way that while it is intuitively perceiving each fact it simultaneously passes on to the next and this I would do until I had learned to pass from the first to the last so quickly that (nearly) no stage in the process was left to the care

of the memory but I seemed to have the whole in intuition before me at the same time. This method will both relieve the memory, diminish the sluggishness of our thinking, and definitely enlarge our mental capacity."

⁶²Regle XI, Pleiade, p. 73. H.R. I, p. 30. "The memory on which we have said depends the certitude of the conclusion which embraces more than we can grasp in a single intuition, though weak and liable to fail us, can be renewed and made stronger by the continuously and constantly repeated process of thought."

⁶³A Arnauld, 29, July, 1648, Pleiade, p. 1306.

⁶⁴Regle XI, Pleiade, p. 73. H.R. I, p. 30. "...a certain movement of thought, which intuitively perceives each fact and simultaneously passes on to the others."

⁶⁵Regle XI, Pleiade, p. 73. H.R. I, p. 30. "...its certitude depends in a certain measure on the memory which must retain the judgments bearing on each of the enumeration points if from their assemblage a single fact is to be drawn."

⁶⁶Discourse, A.T. VI, p. 2. "...an ample and present memory."

⁶⁷Regle III, Pleiade, pp. 44-45.

⁶⁸Regle XII, Pleiade, p. 80. H.R. I, p. 40. "Now when the understanding wishes to have a distinct intuition of particular facts a multitude of objects is of no use to it. But if it wishes to deduce one thing from a number of objects, as often has to be done, we must banish from the ideas of the objects presented whatsoever does not require present attention, in order that the remainder may be the more readily retained in memory."

⁶⁹Regle VI, Pleiade, pp. 55-56; Discourse, A.T. VI, p. 19.

⁷⁰Regle V, Pleiade, p. 52. H.R.I, p. 14. "Method consists entirely in the order and disposition of the objects towards which our mental vision must be directed if we would find out any truth. We shall comply with it exactly if we reduce involved and obscure propositions step by step to those that are simpler and then starting with the intuitive apprehension of all those that are absolutely simple, attempt

to ascend to the knowledge of all others by precisely similar steps."

⁷¹A Mersenne, 27, April, 1637, A.T. I, p. 366.

⁷²Regle XII, Pleiade, p. 89; Regle VII, Pleiade, p. 59.

⁷³Regle VII, Pleiade, p. 58.

⁷⁴Regle XI, Pleiade, p. 72. H.R. I, p. 33. "If after we have recognized intuitively a number of simple truths, we wish to draw any inferences from them, it is useful to run them over in a continuous and uninterrupted act of thought, to reflect upon their relations to one another, and to grasp together distinctly a number of these propositions so far as is possible at the same time.

⁷⁵Regle VI, Pleiade, p. 55. "...to reflect with sagacity to the very minutest of the facts that we have previously perceived."

⁷⁶Med. IV, A.T. IX, p. 49; Regle VI, Pleiade, p. 55. "...they have not so much to be retained in the memory as to be detected by a sort of mental penetration."

⁷⁷Regle VII, Pleiade, p. 58. "...in the same time... have the intuition of each thing and pass to the others... have the intuition of the whole before me simultaneously."

⁷⁸Ent. avec Burman, Pleiade, p. 1358; A Mersenne, 27, April, 1637. A.T. I, p. 366. Regle IX, Pleiade, p. 67.

⁷⁹Regle VII, Pleiade, p. 59. H.R. I, p. 21. "...the connection of each with its neighbor, we shall be entitled to say that we have seen how the first is connected with the last."

⁸⁰Regle XI, Pleiade, p. 72.

⁸¹Regle XIV, Pleiade, p. 106.

⁸²Regle XVIII, Pleiade, p. 115.

⁸³Regle XVIII, Pleiade, p. 117.

⁸⁴Med. VI, A.T. IX, p. 57. "I consider the three lines as present through the force and interior application of my mind."

⁸⁵Oeuvres de Descartes, published by Victor Cousins (Paris 1824). De La Musique, Vol. V, p. 445.

⁸⁶Ibid., pp. 446-447.

⁸⁷Regle IX, Pleiade, p. 67.

⁸⁸De La Musique, p. 466.

⁸⁹Regle XI, Pleiade, p. 72; Regle XII, Pleiade, p. 89; Regle VII, Pleiade, p. 59.

⁹⁰De La Musique, p. 28; pp. 466-477.

⁹¹Regle V, Pleiade, p. 52.

⁹²De La Musique, p. 450. English version contained in Rene Descartes, Compendium of Music, trans. by Walter Robert (Rome 1961), p. 14. "This proportion is often stressed so strongly among the components of a composition that it aids our understanding to such an extent that while hearing the end of one time unit, we still remember what occurred at the beginning and during the remainder of the composition... for then we hear the first two units as one, then we add a third unit to the first two, so that the proportion is 1:3; on hearing unit 4, we connect it with the third, so that we apprehend them together; then we connect the first two with the last two, so that we grasp those four as a unit; and so our imagination proceeds to the end, when the whole melody is finally understood as the sum of many equal parts."

⁹³Ent. avec Burman, Pleiade, p. 1358.

⁹⁴Abrege de Meditations, A.T. IX, p. 10. H.R. I, p. 141. "For although all the accidents of mind be changed, although, for instance, it thinks certain things, wills others, perceives others, despite all this it does not emerge from these changes another mind."

⁹⁵A Mesland, 1645 ou 1646? A.T. IV, p. 346. "...its form which is the soul;" cf. A Elizabeth, 28, June, 1643, A.T. III, p. 694.

⁹⁶Resp. II, A.T. IX, p. 130. H.R. II, p. 58. "If I had the power of conserving my own existence, I should have had a proportionately greater power of giving myself the perfections that I lack for they are only attributes of substance whereas I am a substance. But I do not have the power of giving myself these perfections; otherwise I should already possess them. Therefore I do not have the power of conserving myself."

⁹⁷I Resp. A.T. IX, pp. 86-87. H.R. II, p. 14. "For even though I had existed from all eternity and hence nothing had preceded my existence, none the less, seeing that the parts of time are separable from each other and hence that it does not follow that, because I now exist, I shall in the future do so, unless some cause were so to speak to recreate me at each single moment, I should not hesitate to call that cause which preserves me an efficient cause;" cf. Prin. I, A.T. IX, p. 34; Med. III, A.T. IX, p. 39.

⁹⁸V Resp. Pleiade, p. 492. H.R. II, p. 219. "An architect is the cause of a house and father of his son in respect of coming into being merely, and for this reason, when it is an absolute production, an effect can remain in existence without any cause of this kind; but the sun is the cause of the light proceeding from it, and God is the cause of created things, not only in respect of their coming into existence, but also in respect of their continuing to exist, and must always expend His activity on the effect in the same way in order to make it stay the same thing."

⁹⁹A Hyperaspistes, August, 1641, Pleiade, p. 1134. Kenny, pp. 115-116. "It is certain that nothing can exist without the cooperation of God as there is no sunlight without the sun. There is no doubt that if God withdrew his cooperation, everything which he has created would go to nothing; because all things were nothing until God created them and provided his cooperation."

¹⁰⁰Prin. I, 29, A.T. IX, p. 37. "...faculty of knowledge...we call the natural light."

¹⁰¹Regle I, Pleiade, p. 38.

¹⁰²Discourse, A.T. VI, p. 68.

¹⁰³Med. I, A.T. IX, p. 15.

CHAPTER V

A HISTORICAL PERSPECTIVE OF TIME

The objective of this chapter is to provide a comparative analysis between the theory of time of Descartes and that of both Aristotle and St. Augustine. These two latter historical channels of thought appear to have influenced Descartes as he formulated his theory of time.

Descartes' encounter with Aristotle began at La Fleche, where part of his schooling consisted of three years of philosophical study. In the second year of this philosophy curriculum, Descartes was obliged to read Books I, II and XI of Aristotle's Metaphysics as well as Books I through VIII of the Physics. Book IV of the Physics contained Aristotle's treatment of time.¹ Although Descartes rejected Aristotle's metaphysics,² there is a decided accord in their theories of time. This will become evident in our analysis.

As far as Descartes' encounter with Augustine is concerned, we know that Descartes certainly had read the City of God and the Confessions since he refers to passages from both of these works.³ Some historians contend that the parallels between Descartes and Augustine make evident Augustine's influence on Descartes.⁴ The extent of that

influence is noted by Henri Marrou, who makes the striking observation that not only was Descartes influenced by Augustine but what also is true is that Augustine can be understood in terms of Descartes:

Cartesianism was ranked by his first supporters for its greater honor as an extension of Augustinianism. On the other hand it must be emphasized that by an inverse process the reading of Descartes comes to influence profoundly and permanently men's understanding of Augustine...it is often through the Cartesian prism that they learn to discover Augustinian thought.⁵

Marrou's point seems to be that Descartes and Augustine are so similar that Descartes can be used as a means of access to Augustine's thought.

Descartes never acknowledged any indebtedness to either Aristotle or Augustine, yet he did make known that he was grateful for the schooling he had received at La Fleche. Writing to one of the Jesuits at La Fleche, Descartes expressed his gratitude:

[C]ar je serai ravie de retourner a La Fleche, ou j'ai demeure 8 ou 9 ans de suite en ma jeunesse, et c'est la que j'ai recu les premieres semences de tout ce que j'ai jamais appris, de quoi j'a toute l'obligation a votre Compagnie de Jesuites.⁶

Descartes never pretended to be original in all of his thinking and ideas. What he did claim was that he made the truth, whatever its origin may be, to conform to the exigencies of reason:

Et je ne me vante point aussi d'etre le premier inventeur d'aucunes, mais bien, que je ne les ai jamais receues, ny pource qu'elles avoient ete dites par d'autres, ny pource qu'elles ne l'avoient point ete,

mais seulement pource que la raison me les a persuadees.⁷

What this admission suggests is that Descartes appropriated the thoughts and ideas of others if they were true and useful for his own purposes.

Our comparative analysis will focus on the areas where there are essential and intrinsic similarities between Descartes' theory of time and the theories of time of Aristotle and Augustine. What will become evident is that the resemblance and parallel areas of thought between Descartes and these two historical predecessors are so apparent that it can hardly be doubted that both Aristotle and Augustine exercised some influence on Descartes in the latter's treatment of time. Aside from accomplishing that goal, a historical investigation of this nature will illuminate and cast more light on points that have already been treated in this study.

A. Aristotle

1. Time as the Number of Movement

Unlike Descartes, who treated time in a dispersed and coincidental manner, Aristotle considered time as a special topic in itself confining his treatment to Book IV of the Physics. After working out some difficulties connected with time, Aristotle arrives at a brief definition: "It is clear, then, that time is the number of movement in respect of the 'before' and 'after', and is continuous since it is an

While Aristotle's thesis is that time is not independent of motion, time is the number of movement by virtue of the fact that the motion is constituted by a succession of changes ordered on to another as 'before and after'. Thus, wherever we find things changing we find time. In essence, time numbers not only local motion but anything that undergoes some change. The following text verifies this:

But neither does time exist without change; for when the state of our own minds does not change at all, or we have not noticed its changing, we do not realize that time has elapsed...If, then, the non-realization of the existence of time happens to us when we do not distinguish any change, but the soul seems to stay in an indivisible state, and when we perceive and distinguish we say time has elapsed, evidently time is not independent of movement and change.¹³

The text establishes three things: First of all, time is the number of movement only insofar as movement involves change. This suggests that wherever we find change of any kind that change can be numbered by time. This would then include the changes found in the soul.¹⁴ Secondly, when Aristotle says that the soul only notices time when it notices the changes in thought he also implies that like physical things the soul has a successive duration and is in time. For only things which do not change and are "always" are not in time (cf. ftn. #13). Aristotle maintains that if the soul does not perceive any change it "seems to stay in an indivisible state (cf. ftn. #11). This "seems to stay" is important. What it denotes is that the soul is not actually in an indivisible state, that is, a state of

"always", a state in which there is no change. Rather, although the soul does not perceive any change in its state of mind and hence does not perceive that time has passed, nevertheless the soul is changing. Therefore, like physical things, the soul is in time. The third point made in the text is that it is the perception of change in our minds that is the subjective index of our perception of time. Here Aristotle wishes to emphasize the interdependency of time and change and is not specifically concerned with change insofar as it pertains to the soul. Nevertheless, it is clear that the soul's awareness of the succession in its thought is the ground for the perception of time.

We find a similarity between Aristotle's and Descartes' conception of the soul's relationship to time. For both Aristotle and Descartes, the soul's awareness of its own change signals its temporality:

Je ne connois pas autrement la duree successive des choses qui sont mues, ou meme celle de leur mouvement que je fais la duree des choses non mues; car le devant et l'apres de toutes les durees quelles qu'elles soient, me parait par le devant et par l'apres de la duree successive que je decouvre en ma pensee avec laquelle les autres choses sont coexistantes.¹⁵

Here Descartes articulates what Aristotle has implied, namely, that all things have a successive duration in which there is found the 'before' and 'after'. Both spiritual and material substances have a successive duration, hence, Descartes can easily adopt Aristotle's definition of time as a number and apply it to both spiritual and material

substances.

We have further clarification of what Aristotle means when he calls time a "number of movement". Any movement must cover some distance in a period of time. Magnitude is continuous, and the movement goes with the magnitude. Therefore, the movement is continuous and, if the movement is continuous, so is time.¹⁶ There is, however, a discrete aspect of time, the 'now':

[M]otion, as we said, goes with the magnitude, and time, as we maintain, with motion. Similarly then, there corresponds to the point the body which is carried along and by which we are aware of the motion and of the 'before' and 'after' in it...But the 'now' corresponds to the body carried along, as time corresponds to the motion. For it is by means of the body that is carried along that we become aware of the 'before' and 'after' in the motion and if we regard them as countable we get the 'now'...The 'now' corresponds to the moving body and is like the unit of number.¹⁷

At this point of the discussion, Aristotle is concerned with the function of the 'now' as a number for time. Insofar as the phases of motion are perceived by the intellect, they can be numbered. Thus, we perceive the successive phases of motion, that is, the 'before' and 'after', each one being a 'now' as they are perceived. These are countable as units of one, two, three, etc., just as we count the minutes on a clock. No motion in the real order, however, can be broken up into units of motion since movement and time are existentially continuous.

Number is used in two senses: that which is counted or countable, and that by which one counts.¹⁸ Insofar as the

'before' and 'after' phases of motion are perceived as discrete quantities, they can be regarded as countable. When they are so, we get the 'now'. When Aristotle comes to describe the 'now' as a number in the sense of that which is countable, the 'now' is not a part of time. Just as the point is not a part of the line, and the line is not composed of indivisible points, neither is time composed of indivisible 'nows'.¹⁹ The 'now' as a number is the discrete aspect of time and corresponds to the discrete aspect of motion, namely, the 'before' and 'after' phases which can be isolated only in thought. The mind perceives the 'before' and 'after' as indivisible phases of motion which exist in a certain order and which can be numbered. The 'now' as discrete quantity is a construct of the intellect just as a point on a line is imposed on the line by the intellect.

As a number, the 'now', like the point, functions differently. Aristotle tells us that the 'now' when used as one is both a uniter and divider. "Time, then, also is both made continuous by the 'now' and divided by it."²⁰ The 'now' as a link unites the past with the future as midnight joins Monday to Tuesday. The 'now' as divider divides the past from the future as midnight divides Monday from Tuesday. The intellect determines how the 'now' is to function, that is, whether or not the 'now' is to be used as that which unites the parts of time or as that which is a potential divider of time.

For the recognition of time there must be recognition of the 'before' and 'after'. In order for this to happen the 'now' must function as two:

But we apprehend time only when we have marked motion, marking it by 'before' and 'after'; and it is only when we have perceived 'before' and 'after' in motion that we say that time has elapsed. Now we mark them by judging that A and B are different, and that some third thing is intermediate to them...For what is bounded by the 'now' is thought to be time.²¹

The 'now' as we see has a threefold function: As one point, the 'now' can serve as 1) a connector of time and 2) as a potential divider of time. The 'now' has an additional third function: Used as two points, the 'now' is considered as the extremes that bound the motion. Each of these extremes is a different 'now' to which the mind attends in its perception of continuous motion. Regardless of the function of the 'now', the 'now' as a number is a mental construct.

Can motion be numbered without a numberer? What Aristotle says about the 'now' as a number presupposes that unless there is a soul to number the 'before' and 'after' in motion, there is no time. While Aristotle glosses over the psychological aspect of time he does not fail to see the implications of his definition. He raises the question, Would there be time without a soul to actually number the motion?

Whether if soul did not exist time would exist or not, is a question that may fairly be asked; for if there cannot be someone to count there cannot be anything that can be counted, so that evidently there cannot be number; for number is either what has been, or what

can be counted. But if nothing but soul, or in soul reason, is qualified to count, there would not be time unless there were soul, but only that (movement) of which time is an attribute, i.e., if movement can exist without soul, and the before and after are attributes of movement, and time is these qua numerable.²²

We might say that what time is materially is found in motion, namely, the 'before' and 'after', but time is formally achieved only in the enumerating process of the soul.

While Aristotle defines time as the number of movement, this definition implies that time is also a mode of thought. Without the soul to number there would be no time, but only that which can be numbered, the 'before' and 'after' found in motion. Therefore, when Vigier claims that Descartes' concept of time as a mode of thought is a departure from Aristotle's definition of time as the number of movement, he fails to fully comprehend what is implicit in Aristotle's definition. The difference between Descartes' and Aristotle's definitions of time is that Descartes wishes to emphasize the psychological aspect, while Aristotle, in keeping with his intent to treat time as would a natural philosopher, chooses to exclude the psychological in his definition. However, as the above text indicates, the psychological aspect of time is intrinsic to Aristotle's definition of time as the number of movement.

We have seen Aristotle's treatment of the 'now' insofar as it relates to the ordinal aspect of motion. The 'before' and 'after', indivisible phases, are perceived by the

intellect and taken as countable. Each of the 'nows', when perceived as a discrete quantity, is like a unit and hence, is numerable. This last concept of the 'now' belongs to the order of the intellect; for in the existential order motion cannot be broken up into indivisible phases. Movement corresponds to the magnitude and time to the movement, and all three are continuous.²³

2. Time as a Measure of Motion

When time functions as an attribute of continuous motion, the motion in itself is not per se numbered. It is only measurable because the parts of the motion exist simultaneously without any order of prior and posterior. Motion as measured is analogous to an extended magnitude that has no actual parts; for we measure a line of 10 inches as an unbroken unit even though mentally it can be divided into 10 parts or inches. In considering motion as a continuum Aristotle describes another function of time. "Time is a measure of motion."²⁴ Duration is not Aristotle's primary concern; yet, when time serves as a measure of motion, it measures what is perceived as continuous existence.

While time directly measures motion it indirectly measures the existence of things:

If a thing is 'in time' it will be measured by time. But time will measure what is moved and what is at rest, the one qua moved, the other qua at rest...Hence what is moved will not be measured by the time simply insofar as it has quantity but insofar as its motion has quantity.²⁵

To be in time is to have one's being measured by time. Although Aristotle is treating time as would a natural philosopher, nevertheless time also extends to the duration of corruptible non-physical substances. These substances manifest some kind of change, namely, a change in thought, and hence time exists for them because of this change (cf. ftn. #13). The following text clearly indicates that time serves as a measure of the duration of both physical and non-physical substances since all things are subject to a temporal duration:

[A] thing whose existence is measured by it [time] will have its existence in rest or motion. Those things therefore which are subject to perishing and becoming - generally those which at one time exist and at another do not - are necessarily in time.²⁶

We have earlier noted that Descartes adopted Aristotle's definition of time as the number of movement. Following Aristotle, who describes time as a "measure of motion", we find Descartes similarly calling time a "measure":

[I]l y a des choses encore plus simple & plus universelles, qui sont vraie et existantes...De que genre de choses est la nature corporelle en general, & son etendue; ensemble la figure de choses etendue, leur quantite ou grandeur & leur nombre, comme aussi le lieu ou elles sont, le temps qui mesure leur duree & autre semblable.²⁷

When Aristotle calls time a number of motion the phases of motion are perceived as discrete quantities. When he considers the durational aspect of motion he also refers to time as a measure of motion. In this last function time measures motion insofar as the latter is perceived as

continuous quantity which corresponds to the magnitude. In the same way, Descartes can call time a "measure" because duration is the mode under which we conceive things insofar as they continue to exist.²⁸ Since in his eyes the duration of material and of thinking substances is the same, time can serve to measure the duration of both kinds of substances. While Aristotle as a natural philosopher emphasizes time as a measure of motion, nevertheless, as we have seen, time also measures the duration of all temporal things (cf. ftn. #26).

In describing time as a measure of motion there is always the question of a standard of measurement. Aristotle proceeds in his discussion of time as a measure to tell us that time not only measures the motion but the motion measures the time.²⁹ He then goes on to indicate what motion it is that serves as a measure of time. The ideal chronometer is the motion of the astronomical system:

Time is measured [by motion] as well as motion by time...if then what is first is the measure of everything homogeneous with it, regular circular motion is above all else the measure, because the number of this is the best known.³⁰

What Descartes has to say about a standard of measure seems to be an adaptation of the above:

Mais, afin de comprendre la duree de toutes les choses sous une meme mesure, nous nous ferons ordinairement de la duree de certains mouvemens reguliers qui sont les jours & les annees, & la nommons temps, apres l'avoir rien, hors de la veritable duree des choses, qu'une facon de penser.³¹

Descartes' points seem to be the same as Aristotle's, namely, that time and motion are reciprocally measured and that

circular motion, being the most uniform and regular, serves as the optimum standard of measure. In conjunction with the motions of the heavens Descartes also recognizes that the motion of the hands of a clock serve equally well as a means of measuring time.³²

While Descartes acknowledges time and motion as reciprocal measures, something more is involved. Descartes' preoccupation with mathematics adds a nuance to the issue. From a mathematical perspective it is less a question of the reciprocity of time and motion in their measuring as it is a question of their intrinsic measurability. Time can only be conceived as a kind of measure if there is something measurable, that is, a species of continuous quantity. Descartes' definition of dimension bears this out:

Par dimension nous n'entendons rien autre chose que le mode et le rapport sous lequel un quelconque est juge mesurable, en sorte que non seulement la longueur, la largeur, et la profondeur sont des dimensions... la vitesse et ainsi d'une infinite d'autre choses de cette sorte. Par la il est clair qu'il peut y avoir dans un meme sujet une infinite de dimensions differentes, que celles-ci n'ajoutent absolument rien aux choses mesurees, et qu'elles sont comprises de la meme maniere, soit qu'elles aient un fondement reel dans les sujets eux-memes, soit qu'elles aient ete inventees par notre esprit. C'est en effet quelque chose de reel...la division du siecle en annees et en jours; mais ce n'est pas quelque chose de reel que la division du jour en heures et en minutes, etc. Et cependant toutes ces choses sont equivalentes, si on les considere seulement sous le rapport de la dimension.³³

Fundamentally, there is no difference between the motion of the astronomical system or the motion of the hands of a clock. They are both species of measurable quantity which is per se

continuous quantity analogous to spatial extension.³⁴ In sum, Descartes adds a mathematical perspective to his treatment of time--a matter which Aristotle does not consider in Book IV of the Physics.

However, the question of measurement per se is treated by Aristotle in Book X of his Metaphysics and we can apply what he says there to time. Any measuring process uses number. Although Aristotle distinguishes time as the number of movement from time as a measure of movement, nevertheless, time as a measure is still a number or it could not measure quantity:

For measure is that by which quantity is known; and quantity qua quantity is known either by a 'one' or by a number, and all number is known by a 'one'.³⁵

Time as a number functions to express the ordinal aspect of motion. The 'before' and 'after' phases of movement are perceived as discrete quantities which, like the unit, are countable. Since all measure uses number and since time is a measure, time also is a number by which continuous motion qua quantity is known.

Following Aristotle, Descartes defines time as the number of movement. In doing this, Descartes recognizes that duration has an ordinal aspect to it, namely, the 'before' and 'after' and that time serves as a number to express this order. Moreover, like Aristotle, Descartes describes time as a measure of duration and that duration is continuous and analogous to extension.³⁶ As a measure

of duration time is also a number. This is so because, as Descartes recognizes, there is a "double usage des nombres... les meme nombres expliquant tantot l'ordre et la mesure."³⁷

In Aristotle's discussion of time as a number, the 'now' was projected as a construct of the intellect. However, when Aristotle shifts from the abstract order to the concrete order where changes take place in continuous time, the 'now' must be perceived in terms of having actual existence. Thus we no longer find that the 'now' is not a part of time (cf. ftn. #19). As a part of continuous time the 'now' has ontological status. The move from the epistemic aspect of the 'now' to the existential aspect of the 'now' places the 'now' with the other moments in time,

so that since the 'nows' are in time, the 'before' and 'after' will be in time too; for in that in which the 'now' is, the distance from the 'now' will also be.³⁸

Yet the 'now' as a part of continuous time is indivisible.

'Presently' or 'just' refers to the part of future time which is near the indivisible present 'now'.³⁹ We might ask how the 'now' can be indivisible and still be a part of continuous time since "nothing that is continuous can be composed of indivisibles"?⁴⁰ In what sense does Aristotle understand the 'now' to be indivisible? The answer can be found in Aristotle's Metaphysics, where he discusses the concept of the 'one'. We can think about something as being one in itself and in this sense it is indivisible.

'[T]o be one' means to be indivisible; means being essentially a 'this' and capable of being isolated

either in place, or in form of thought; or perhaps to be whole and indivisible.⁴¹

The line as a continuum is a whole in itself, yet it is divisible into parts. But that divisibility still remains potential, so that the line perceived as an actual whole is really indivisible. Moreover, the line is indivisible in the sense that it is one and not another. It is distinguished as a unit itself apart from other extended wholes. Analogously, the 'now' as a part of time is one in itself. It is neither the past nor the future, in which case it may be said to be indivisible in itself since it contains nothing of the past or of the future. The 'now' is that part of time to which the other parts of time are related to as 'before' and 'after':

But 'before' is used contrariwise with reference to past and future time; for in the past we call 'before' what is farther from the 'now', and 'after' what is nearer, but in the future we call the nearer 'before' and the farther 'after'. So that since the 'before' is in time, and every movement involves a 'before' evidently every change and every movement is in time.⁴²

The 'now' as a part of time has duration, for at one time the 'now' was a 'before' and later it will become an 'after'. Thus just as the 'before' is always in time, so every 'now' is in time. The 'now' as the indivisible present is simply the negation of the past and future. Nevertheless, it is a negation that is always referable to the soul since it is the soul that isolates the 'now' in the form of thought and separates it from the past and future.

As Aristotle notes in the above passage, we call 'before' what is farther from the 'now' and 'after' what is nearer. The 'before' and 'after' have existence as parts of time in the sense that every change and movement involves a 'before' and 'after' phase; a body is here and then it is there. In the same way the 'now' is a part of time in the sense that there is always a present phase of motion. To this present phase the soul attends and calls it 'now'; to it the soul orders the other phases as 'before' and 'after', temporally known as the 'past' and 'future'. Thus, time which includes the past and future in addition to the 'now' can only be conceived in terms of the soul. For the latter perceives the phases of motion as occurring in a succession in which there is always a 'before' and 'after'. At the same time, the soul perceives the present phase which the soul distinguishes from the 'before' and 'after' phases.

Inevitably Aristotle cannot extricate himself from the fact that time is a mode of thought and that it is the way in which we think about the duration of things insofar as that duration is constituted by successive numerable and measurable change. Time is the number of that change. Consequently, Descartes' definition of time simply makes explicit what is implicit in Aristotle's definition, namely, that time is a mode of thought. Aristotle alludes to the fact that the existence of the soul is a condition for time,

but he does not spell out the dynamics of that process. Yet the soul is necessary for time. And while Descartes' theory of time, as we have analyzed it, bears a striking resemblance to Aristotle's, Descartes, as a metaphysician, could go further and introduce the psychological aspect. He does this while utilizing Aristotle's definition which comes from the standpoint of a natural philosopher.

3. Summary of Aristotle vs. Descartes

From different perspectives and for distinctly different purposes, Aristotle and Descartes both consider time as the number of movement and measure of motion. Their respective concerns are not the same but there is a consensus on the basic elements that define time. As a student of nature, Aristotle's chief concern was the locomotion of physical substances and he explored time in relation to that concern. Hence, his treatment of time was an integral part of his Physics. His metaphysical thoughts were subjects treated in a separate work. From a different vantage point Descartes chose to incorporate time into his dualistic metaphysics, yet in accordance with Aristotle he viewed time as the number of movement. He did this, however, with the stipulation that such a definition is appropriate only if we understand that it applies to both material and spiritual substances. For they both have a common successive duration in which there is found a 'before' and 'after' that can be

numbered by time. For this reason, Descartes was interested in formulating a theory of time that would accommodate his dualistic kind of metaphysics. While that theory was part and parcel of his physics, he never treated it as a topic that fell under the category of physics. Although the goals of Aristotle and Descartes remain different, the difference is of no substantive consequence.

Aristotle proposed that time is a number of movement insofar as the changes in movement can be perceived as 'before' and 'after'. As such, they are countable units that can be numbered. Yet Aristotle also implies that time as a number can apply to the changes that take place in the soul since these changes take place in an order of 'before' and 'after', by which we can regard them as countable. Aristotle describes time as a measure of motion that indirectly measures the duration of all temporal things, including the soul. As we have seen, however, the durational aspect of time and its relation to motion were of secondary importance to Aristotle, and even less important to him was the durational aspect of time as it relates to the soul.

For Descartes, on the other hand, time measures the duration of both material and spiritual substances. In terms of the Cartesian physics, the ordinal aspect of time predominates. Movement, conceived as continuous quantity, was of secondary importance, although Descartes recognized the durational aspect of motion and admitted its measurability

since it is a species of continuous quantity. However, in terms of Descartes' goals for a mathematical kind of physics, the ordinal and discrete aspect of both motion and time played a more important role insofar as it applies to material substances.

Such is not the case when he considers time as it relates to the soul. While Aristotle was not interested in developing with any amplitude a theory of time as it related to the soul, Descartes' main objectives demanded that he propose a theory of time which would focus on the duration of the thinking substance. For it is the "cogito ergo sum" that constitutes the noetic foundation for Descartes' science. That truth serves as the primary truth from which all others could be deduced, and it establishes the thinking substance as an agent of knowing whose duration is a continuous movement toward an ever-increasing knowledge about the mysteries of nature. Because the soul plays such a pivotal role in the Cartesian philosophy, it follows that unlike Aristotle, Descartes does not hesitate to stress the psychological aspect of time.

The comparative analysis between Aristotle and Descartes reveals obvious similarities of terminology and parallels in thought which provide strong reasons to surmise an Aristotelian influence on Descartes' view of time. To what degree Aristotle's theory of time was operative as a positive and decisive influence cannot be assessed with an incontestable

certitude. Yet the correspondence of thought between Descartes and his predecessor and the familiarity of Descartes with Aristotle, are supportive evidence that Descartes utilized Aristotle's theory of time for his own purposes. This Descartes was able to do without altering or undermining any of the intrinsic components of Aristotle's theory of time. What he found valid in Aristotle's theory he was able to appropriate as his own because, by his own admission, Descartes submitted all of his ideas to the test of reason, regardless of their genetic origin (cf. ftn. #7).

While not diminishing the worth of Aristotle's theory of time, J. Callahan makes a point that is well taken:

To perceive an order in the 'nows' and number motion accordingly demands that there be some recollection of the 'nows' that are no longer in existence. But the process by which the mind does this does not belong to natural philosophy. Aristotle passes over the psychological aspect of time, which was later to be stressed by St. Augustine.⁴³

Because the psychological aspect is vital to Descartes' theory of time, we can look to Augustine for further insight into the role that the soul plays in relation to time.

B. St. Augustine

In Books Eleven and Twelve of the Confessions, St. Augustine provides a concise and concentrated treatment of time and eternity. He looks at both the metaphysical and psychological aspects of time. From the metaphysical perspective, time has objective reality. Addressing God,

St. Augustine says, "you are the maker of all times...the eternal creator of all times, and [that] times are never co-eternal with you."⁴⁴ As a created reality, time is distinct from eternity. For time does not exist without some change, while in eternity there is no change. In eternity, which applies only to God, we find that the whole is present all at once. In time we find creatures that undergo change, the parts of which cannot be simultaneous, but succeed one another.⁴⁵

In the Confessions, St. Augustine chooses not to develop an elaborate treatment of the correlation between time and change. Elsewhere, however, he is explicit about the fact that where we find change of any kind we find time:

God then, who lives in an unchangeable eternity, created simultaneously all things from which the course of time would run and space would be filled and the ages would unfold by the movement of beings in time and space... He established the spiritual creation above the corporeal because the spiritual is changeable only in time but the corporeal is changeable in time and place. For example, a soul moves in time, remembering what it had forgotten or learning what it did not know, or wishing what it did not wish.⁴⁶

Augustine has made two salient points. First of all, time is contrasted with eternity since in the former we find successive change, and in the latter we find no change nor do we find succession. In eternity, the whole is present all at once. Secondly, Augustine has made the point that incorporeal substances manifest cognitive change and therefore are timely; whereas corporeal creatures are changeable both in time and in place. Time is an intrinsic property of

all creatures. These points are reiterated by Descartes. In discussing the duration of the thinking substance, he categorically opposes that duration to that of God's duration, noting the successive duration of the thinking substance that is revealed in the successive nature of thought:

Et quand meme il n'y aurait pas de corps du tout, on ne pourrait pas dire pourtant que la duree de l'esprit humain fut tout a la fois tout entiere, comme la duree de Dieu, parce que nous avons manifestement connaissance de la succession dans nos pensees, tandis qu'aucune succession ne peut etre admise dans les pensees divines.⁴⁷

From a metaphysical perspective, St. Augustine hypothesizes time and establishes that time is a created reality. However, it is clear that if there were no creatures whose duration admitted of successive changes, there would be no time. Time and successive duration are correlative concepts, and St. Augustine never means to suggest that time would exist in itself apart from created substances. "If there were no motions of either a spiritual or corporeal creature, by which the future moving through the present would succeed the past, there would be no time at all."⁴⁸ Where we find successive change we find time, and correlatively, where we find time we find successive change. Since all creatures are created by God, it follows that, concomitant with creation, time came into being.

What is time? With that question Augustine offers a descriptive analysis starting with a presentation of the

difficulty. We know time exists for we perceive and measure it, yet what is it we measure? For the past is no longer, and the future is not yet, and the present is perpetually ceasing to be and tending toward non-being.⁴⁹

While the past and future are obvious parts of time that do not exist, it remains to be seen whether the present exists to be measured. In an interesting analysis, St. Augustine concentrates on the meaning of the 'present'. What evolves from his analysis is that what we call 'present', whether it be the present hundred years, the present year, month, day, or even the present moment, are not really 'present'. For we find that each of these parts of time can be divided into past and future parts. The present year, for example, contains both the past months and the future months, so that the present year is, in fact, not wholly present. What then can be called the 'present'?

If any part of time is conceived that can no longer be divided into even the most minute parts of a moment, that alone it is which may be called the present. It flies with such speed from the future into the past that it cannot be extended by even a trifling amount. For if it is extended it is divided into past and future. The present has no space.⁵⁰

In commenting on the above passage, Gilson makes the following observation:

It is the essence of time to have only a fragmentary existence because the past of anything is no more at the moment of duration, and its future has yet to be. As for its present, it can only consist of an indivisible moment, because if it is extended in duration ever so little, it falls into a past which is no more and an immediate future which has yet to be. There is

scarcely any need to point out that this conception of time will also be that of Descartes.⁵¹

Gilson is correct on this point: for both Augustine and Descartes, time has only a fragmentary existence. For Augustine, time is fragmentary because it is an attribute of fundamentally finite creatures whose existence in time depends on God. For "if He [God] were, so to speak, to withdraw from created things His creative power, they would straightway relapse into the nothingness in which they were before they were created."⁵² God, in creating timely beings, created time and so, without the conserving power of God, not only creatures but also time would cease to exist.

Descartes' concept of time in substances parallels Augustine's. Time is an intrinsic property of all created substances. If time is fragmentary, it is solely because it corresponds to the fragmentary duration of created substances. Such duration is constituted by a succession of moments in which the past, no doubt, is irrevocably non-existent. Because the substance lacks a principle of auto-continuation, any future existence is uncertain.⁵³ Moreover, even the present moment carries within it the tendency toward non-being. If God withdraws his power of conservation, the substance may "cesser d'etre dans chaque moment de sa duree."⁵⁴ The parity in language between what Augustine says (cf. ftn. #52) and what Descartes says in one of his letters cannot be more obvious:

Et il n'est pas douteux que si Dieu arretait son concours, aussitot toutes les choses qu'il a crees retourneraient au neant parce que, avant qu'elles ne fussent crees et qu'il ne leur pretat son concours, elles n'etaient rien.⁵⁵

In analyzing Descartes' agreement with St. Augustine on the concept of the 'present', it must be said that Gilson incorrectly maintains that, for St. Augustine, the present can only consist of an indivisible moment because, if it is extended in duration ever so little, it falls into a past which is no longer and an immediate future which has yet to be. St. Augustine does not say that the present is not extended in duration. What he says is that it cannot be divided into past and future, and that the present has no space (cf. ftn. #50). The import of this last statement cannot be dismissed. Augustine conceives the present to be indivisible. The mathematical point as discrete quantity is opposed to geometric extension under the category of continuous quantity. As discrete quantity, the point is a countable unit, but it cannot be measured or divided. Analogously, the 'present' conceived as discrete quantity has no extension and is, therefore, not measurable or divisible into parts. However, like the point, the 'present' is discrete quantity and an indivisible unit in itself. As a unit it can be distinguished from other units. This does not mean that it is absolutely indivisible in the sense that it has no duration. It means only that it is one in itself and not another, namely, it is neither the

past nor the future.

Moreover, the 'present' to which St. Augustine refers in Gilson's quotation is not the concrete 'present' moment that constitutes one of the parts of the duration of the created substance. It is the 'present' considered in the abstract. An analysis of the concept reveals that the 'present' could not be 'present' if it is divided into a past and future. Since it cannot be divided, it is (analogously to the mathematical point) indivisible. Obviously, then, it is not extended (in space). This abstract perspective says nothing at all about the 'present' as it pertains to the existing creature. If the 'present' is quantitatively unextended (has no space) as an analysis of the concept implies, this does not mean that the 'present' is unextended in the concrete order as it applies to the duration of created things. And nowhere in this particular text (cf. ftn. #50) does St. Augustine ever say that the present is without duration. Hence, Gilson is mistaken in his interpretation of this particular text, and, as our own study demonstrated, Descartes never proposed that the present was indivisible in the sense that it has no duration.

As St. Augustine proceeds further into the inquiry and focuses on the intervals of time, he asserts that while the past and future are said not to exist, certainly, the present does exist.⁵⁶ Time is measured and what is measured

must be perceived. Now "nothing can be seen except what is present", therefore, it is the 'present' that is perceived and measured.⁵⁷ This 'present' that is measured must have duration, for if it were absolutely indivisible and without duration, it could not, in fact, be measured. We cannot measure the past because it is gone and we cannot measure the future because it has not yet come. What we measure must be the 'present'. Since we measure the past as being 'long' or 'short' and the future as being 'long' or 'short' they must in some sense be 'present'.

St. Augustine finally arrives at the insight that what we perceive is not the 'past' itself but images of the past which are present to the mind through memory. And in the future what exists is not the 'future' itself but those signs or causes which are 'present' through premeditation or expectation. Thus, it is a misnomer to say that there are three times, past, present, and future. We might say that there are three times only with qualification:

It is now plain and clear that neither past nor future are existent, and that it is not properly stated that there are three times, past, present, and future. But perhaps it might properly be said that there are three times, the present of things past, the present of things present, and the present of things future. These three are in the soul, but elsewhere I do not see them: the present of things past is in memory; the present of things present is in intuition; the present of things future is in expectation.⁵⁸

Even if the past and future are present, still that present is not extended in space. Thus what do we measure?

Since time is what we measure, St. Augustine proposes the possibility that the movements of the sun, moon and stars constitute time. He dismisses this as untenable. For even if the movement of the heavenly bodies would stop, one would still have the movement of the potter's wheel and there would still be time.⁵⁹ St. Augustine finally arrives at a definition of time by appealing to the psychic order. "Time is nothing more than a distention: but of what thing I know not, and the marvel is, if it is not of the mind itself."⁶⁰

As to the question of what I measure when I measure time: Augustine says that I measure tracts of time in my soul. The 'present' state is what I measure, not the things which pass away nor the things that are yet to come.⁶¹ If the 'present state' is what I measure, how can this yield a measure since all measurement presumes a standard of measure to which the measured can be compared? Augustine answers this by alluding to the fact that the mind experiences different states of consciousness and it can estimate the duration of one state by comparing it with the duration of another state:

How is it when we measure stretches of silence, and say that this silence has lasted for as much time as that discourse lasted: Do we not apply our thought to measurement of the voice, just as though it were sounding so that we may be able to report about the intervals of silence in a given tract of time? Even though both voice and mouth be silent in our thought we run through all poems and verses, and any discourse, and any other measurements of motion. We report about

tracts of time how great this one may be in relation to that, in the same manner as if we said them audibly.⁶²

Even if there existed no objective standards of measure outside the soul, the latter can still measure the 'present state' as 'long' or 'short' by comparing or contrasting it with another state of consciousness that has its own interval of time.

Augustine defines in a fuller way what he means by the 'present state'. "The impression that passing things makes upon you [mind] remains, even after those things have passed. That present state is what I measure, not the things which pass away so that it be made. That is what I measure when I measure tracts of time."⁶³ Implicit in the 'present state' is the permanence of attention through which the mind conserves the impressions of the past and anticipates the future. The mind through its present intentionality stretches itself out so that the present state includes the past and future 'as present':

If someone wished to utter a rather long sound and he determined by previous reflection how long it would be, he has in fact already silently gone through a tract of time. After committing it to memory he has begun to utter that sound and he voices it until he has brought it to his proposed end. Yet, it has sounded and it will sound. For the part of it that is finished has surely sounded; what remains will sound. So it is carried out, as long as his present intention transfers the future into the past, with the past increasing by a diminution of future, until by the consumption of the future the whole is made past.⁶⁴

The present attention of the mind acts as the permanent element in the transition from the past to the future. Through an act of intentionality the subject unifies the moments:

But how is the future which as yet does not exist, diminished or consumed, or how does the past, which no longer exists, increase, unless there are three things in the mind, which does all this? It looks forward, it considers, it remembers, so that the reality to which it looks forward passes through what it considers into what it remembers...Yet attention abides, and through it what shall be present proceeds to become something absent.⁶⁵

The amplitude of the mental field of attention must be wide enough to include past and future as present. Augustine provides an example of how the mind synthesizes the moments into a cohesive whole:

I am about to recite a psalm that I know. Before I begin, my expectation extends over the entire psalm. Once I have begun, my memory extends over as much of it as I shall separate off and assign to the past. The life of this action of mine is distended into memory by reason of the part I have spoken and into forethought by reason of the part I am about to speak. But attention is actually present and that which was to be is borne along by it so as to become past. The more this is done and done again, so much the more is memory lengthened by a shortening of expectation, until the entire expectation is exhausted. When this is done the whole action is completed and passes into memory. What takes place in the whole psalm takes place also in each of its parts and in each of its syllables. The same thing holds for a longer action, of which perhaps the psalm is a small part. The same thing holds for a man's entire life, the parts of which are all the man's actions.⁶⁶

While the moments pass, attention abides and provides the unity and continuity to the totality of the moments which constitute the successive duration of the subject.

We know that the mind performs three functions: memory, expectation, and intuition (cf. ftn. #58). Through the medium of attention the past and future are held together and integrated into the present state. Insofar as attention is projected by Augustine as the activity by which the past and future are synthesized into the present attention, it serves to transpose the succession into a quasi-simultaneity in which there is a co-incidence of the past, present, and future. From an epistemic standpoint, that quasi-simultaneity appears as the 'present' in which the mind has an integrative insight (praesens de praesentibus contuitus) of the cumulative whole (cf. ftn. #58).

Viewed from that perspective, the present (in which the mind focuses its attention and has a direct perception or intuition [contuitus] of things present to the mind) resembles Augustine's description of eternity in which the "whole is present" simultaneously (cf. ftn. #45). Thought is transitory although the things that are thought are not transitory. Yet attention abides for a while and by means of it the soul turns the "mind's eye" to behold a vision of "the intelligible things in an incorpreal light that are so present to the gaze of the mind."⁶⁷

The epistemic aspect of Augustine's theory of time that we noted calls to mind Descartes' doctrine of method for attaining truth in the sciences. In the context of that method we find an affinity between certain elements

descriptive of both Augustine's and Descartes' theories of time. There is, for Descartes, as there is for Augustine, a synthetic activity of the mind that conjoins the past and future with the present to form a whole in which there are no distinguishable parts. From an epistemic standpoint, that synthesis culminates in a present intuition in which the mind has an immediate and simultaneous perception of the whole. The synthetic operation that Augustine describes in the recitation of a psalm has a correlate in the synthetic operation found in the enumeration method, the goal of which is to have an integrative intuition of the total series of intuitions.

In Rule XI Descartes explains how intuition and enumeration aid and complete each other. Enumeration presupposes that all of the steps in the deductive process have been intuited by single intuitions. Descartes wishes to prescribe the manner in which the mind should function in order to keep all of the links within its present range of attention. As he says, "nous cherchons plutot tout ce qui peu aider a retenir l'attention de notre pensee."⁶⁸ When the deductive process includes many complex facts enumeration is used to coalesce the single intuitions. In brief, we can see how the two processes work together:

[C]es deux operations s'aident et se completent mutuellement, au point de paraitre se confondre et en une seule, par un certain mouvement de la pensee, qui voit chaque chose en meme temps par une intuition attentive et qui passe aux autres.⁶⁹

At the very moment that the mind has a vision-like knowledge of one fact, it passes at the same time to another. As the text indicates, the consequent must be included in the present range of attention. However, the enumeration process is constituted by a chain of propositions that are ordered one to another as antecedent and consequent. The purpose of enumeration is to strengthen and renew the power of the mind so that it can extend its present range of attention to include both the antecedent and consequent. In a more detailed manner, Descartes spells out the dynamics of the enumeration process:

Après que nous avons eu l'intuition de quelques propositions simples, si nous en deduisons quelques autres, il est utile de les parcourir toutes d'un mouvement de pensée continu et ininterrompu, réfléchir à leurs relations mutuelles, et, autant que cela est possible, de concevoir distinctement plusieurs choses à la fois; car c'est ainsi que notre connaissance acquiert beaucoup plus de certitude et la puissance de notre esprit une plus grande étendue.⁷⁰

In every moment the mind attentively reflects on both the antecedent and consequent. The reflection is necessary to insure that no link is left out in the long chain of reasoning, for without the inclusion of every link the certitude of the conclusion is jeopardized.⁷¹ Moreover, the other condition for certitude is the uninterrupted movement of the mind which insures a cohesiveness between the diverse mental acts. If the enumeration process is effected as prescribed, attention abides long enough to focus on both the immediate antecedent and consequent so

that the mind can simultaneously see their binding relationship as well as their distinctions. This is possible only if the antecedent and consequent are included in the present intuition. The antecedents and consequents as original single mental operations were at one time future and another time past. However, in the process of enumeration they are "as present" in the moment of attention. Descartes then has the instrument by which he can enjoy Augustine's three 'presents' as Augustine does in the *contuitus*.

For Augustine, memory plays a pivotal role in the synthetic process. It must be noted that when he gives us an example of the recitation of the psalm he states that it is a psalm that we already know. Thus, before we begin we have a preview of the whole psalm. This presumes that we have the psalm committed to memory and that during the recitation of the psalm the memory extends itself to a certain portion which is about to be uttered. The due order of words are uttered in succession because we are able to foresee in thought what comes next. It is our memory of what comes next that enables us to foresee the proper order of what follows. Hence, contrary as it may sound, anticipation presumes memory. Memory preserves the order of the syllables about to be uttered, and it is that retention of the order that insures the goal of the recitation, which is to perceive the psalm as a unified whole.

Like Augustine, Descartes recognizes an equally important and similar role for memory in the synthetic process. In enumeration, as a repeated process of reviewing previously perceived truths, the function of memory cannot be conceived apart from anticipation. Intrinsic to the process is the uninterrupted movement of thought which preserves the correct order of the steps that constitute the series. If the intended result is achieved, it presumes that what has been retained by the memory is continuously being anticipated in the inferential movement from antecedent to consequent. The mind must continuously anticipate the next step (previously perceived and at present retained by memory) so that no link is missing, the latter condition being vital for the certitude of the conclusion. While memory and anticipation can be distinguished by analysis, in the enumeration process they are essentially united. The reciprocity of anticipation and memory is demonstrated in the following rule:

[P]lusieurs choses sont connues avec certitude, bien qu'elles ne soient pas elles-memes evidentes, pourvu seulement qu'elles soient deduites a partir de principes vrais et connus, par un mouvement continu et ininterrompu de la pensee qui a une intuition claire de chaque chose. C'est ainsi que nous savons que le dernier anneau d'une longue chaine est relie au premier, meme si nous n'embrassons pas d'un seul et meme coup d'oeil tous les intermediaires dont depend ce lien, pourvu que nous avons parcouru ceux-ci successivement, et que nous nous souvenions que du premier au dernier chacun tient a ceux qui sont proches....[deduction] elle recoit en un sens sa certitude de la memoire.⁷²

We must guard the memory of the order of antecedents and consequents to insure that the conclusion drawn is incontestable. Paradoxically, the memory of the order always implies a memory of the future, those steps in the inferential process that follow one another in succession. While memory (and its implied anticipation of the future) plays a decisive role in the enumeration process, it only finds its import in terms of the broader synthetic activity of the mind.

For both Augustine and Descartes, that activity is fundamental not only in terms of particular given instances such as the recitation of a psalm or in the enumeration process; the synthetic activity of the mind has broader ramifications in the explication of Augustine's and Descartes' theories of time. That cognitive activity provides a compelling case for the continuity of time as well as the continuous duration of the soul. The import of the synthetic activity justifies further consideration and clarification.

In the De Musica, Augustine provides a clear example of the dynamics of the synthetic operation by which the soul integrates the past and future into the present. For Augustine, music is the science of moving well, for whatever moves and keeps harmoniously the measuring of times and intervals can already be said to move well.⁷³ Besides giving a definition of music in Book One, Augustine also

discusses the species and proportions of time-laden movements, matters which belong to the consideration of this discipline. Hence, we are given a mathematical theory of music which discusses sound and its harmony in terms of movements collated in a certain order. The essence of movement is order. The time values have a "bond of order" and we derive pleasure if "the first are harmoniously bound with middle and middle with the last".⁷⁴

There are areas of correspondence between Descartes' Compendium Musicae and Augustine's De Musica. Considering music to be a form of applied mathematics, Descartes, like Augustine, presents a mathematical theory of music. At the outset, Descartes establishes that the basis of music is sound and one of the attributes of sound is the difference of duration or time.⁷⁵ Following Augustine, Descartes discusses music in terms of time-values, that is, proportions and types of mensuration used in music. One of the main points Descartes treats is the pleasure that the melody produces. Such pleasure is contingent on the correct order of the musical tones that constitute the consonances. The proper sequence of notes must be followed throughout the entire time-intervals of the melody if the intended sound is to be heard.⁷⁶

While Descartes confines his discussion of time-mensurations as they occur in the science of music, St. Augustine extends his consideration of time-values to the

movements of sound in general. In the context of that broad category we find a correspondence between Augustine's treatment of time in Book XI of the Confessions and Book Six of the De Musica, where we see how the soul is distended and how it synthesizes the parts into a cohesive whole. Even in the recitation of a syllable there must be a mental field of attention that includes the past and future:

For any syllable, no matter how short, since it begins and stops, has its beginning at one time and its ending at another. Then it is stretched over some little interval of time and stretches from its beginning through its middle to an end. So reason finds spatial as well as temporal intervals which have an infinite division and so no syllable's end is heard with its beginning. And so, even in hearing the shortest syllable, unless memory helps us have in the soul that motion made when the beginning sounded, at the very moment when no longer the beginning but the end of the syllable is sounding, then we cannot say we have heard anything.⁷⁷

There are three points regarding this passage of which special mention should be made. First of all, there must be a synthesis of the antecedent and consequent parts in order for the syllable to be heard as a unit in itself. The soul must be able to retain the beginning of the sounded syllable while it is uttering the end of the syllable. Secondly, there corresponds to the movement of speech uttered in a time interval, a motion in the soul that must take place in the same time interval. Thirdly, the motion in the soul must be continuous so that the attention is always fixed on what has immediately preceded and what

immediately follows. Otherwise, as St. Augustine tells us, we will be unaware that a sound has been heard. If the motion of the soul were interrupted, then there would be no synthesis which is the condition for the perception of the syllable as a whole.

It is only by virtue of a continuous synthesis that the elements that compose a whole are not lost. Since each and every element within the whole is essential to that whole, then the soul, through its synthetic operation, must carry along all of the preceding parts as it hears the present sound. What is true of the perception of a syllable is true in the case of a poem:

And in a poem, if syllables should live and perceive only so long as they sound, the harmony and beauty of the connected work would in no way please them. For they could not see or approve the whole, since it would be fashioned and perfected by the very passing away of these singulars.⁷⁸

Let us compare what Augustine says in the above two passages with a passage from Descartes' Compendium Musicae. Discussing the parts of a composition and the proportions which must prevail therein Descartes writes:

Or cette proportion est souvent gardee avec tant d'exactitude dans les membres d'une chanson, qu'entendant encore la fin d'un temps, nous nous ressouvons par son moyen du commencement et de la suite de la meme chanson; ce qui arrive ordinairement si toute la chanson est composee de 8, 16, 32 ou 64 membres et davantage, pourvu que toutes les divisions augmentent en proportion double; car alors ayant entendu les deux premiers membres, nous les concevons comme un seul; ayant entendu le troisieme, nous le joignons avec les deux premiers, en sorte que la proportion est triple; lorsque nous entendons la quatrieme,

nous le joignons au troisieme, et de ces deux derniers nous n'en faisons qu'un; puis, joignant les deux premiers aux deux derniers, on concevra ces quatre membres ensemble comme un seul, et c'est ainsi que notre imagination se conduit jusques a la fin, ou elle se represente toute la chanson comme un corps entier compose de plusieurs membres.⁷⁹

Here is an echo of what we found in the passage from St. Augustine. In the above text of Descartes we note that a synthesis of the antecedent and consequent must be taking place in each time interval when the latter constitutes the present range of attention. That synthesis binds the antecedent to the consequent in a necessary relationship while it simultaneously distinguishes the two. Secondly, the movement must be continuous and uninterrupted so that no element is missing from the work. Thirdly, the mind must be able to retain its attention long enough so that the present can include the antecedent and consequent "as present". The synthetic operation illustrates the manner in which the soul moves in time, a clear indication and reflection of the fundamental successive, yet continuous, nature of the soul's duration.

Going back to St. Augustine's De Musica, we find him alluding to the fact that time is in the soul and that time is projected as a species of continuous quantity analogous to extension:

Why in rests isn't our sense offended by a deficiency, if not because what is due that same law of equality, although not in sound, is yet made up in a spread of time? Why, too, is a short syllable taken for a long one when followed by a rest--and not by convention,

but by natural consideration directing the ears--if not because by the same law of equality we are prevented, in a longer time-span, from forcing the sound into a shorter time? And so the nature of hearing and passing over in silence allows the lengthening of a syllable beyond two times; so what is also filled with rest can be filled with sound.⁸⁰

Commenting on the first part of this passage, R. Taliaferro makes the following observation: "The rest, the absence of a sensible motion, is itself the object of the time-count and plays its role on the same level as a sensible sound. Its absence is counted by the 'spread of time' (spatium temporalis). This is the forerunner of the distentio animi of the Confessions."⁸¹ What is also worth noting in the text is that the spread of time can be occupied by either rest or sound. This demonstrates that the duration of the soul is both successive and continuous since there occur in the soul changes in thought that are spread over periods of time. The awareness of the absence of sound, i.e., the awareness of rest, follows the awareness of the sound itself. And these changes continue to transpire over the course of the perception of the syllables being sounded.

Moreover, the awareness of the 'before' and 'after' parts of the verse is primarily an awareness of the changes of thought that occur in the time intervals which are ordered one to another as 'before' and 'after'. If the soul were only aware of sound, i.e., sensible motion, then perhaps time may well be, as Aristotle maintains, the number of motion as it applies to the physical order. However, as

Augustine notes, we measure not only the motion of a body but also its rest by means of time.⁸² In the case of the soul, the awareness of rest corresponds to some part of the distention of the soul's duration and that duration has its own time. The soul can measure the time of its awareness of rest and contrast it with the time of the awareness of sound, calling one "longer" and the other "shorter". The consciousness of rest must be conceived as a species of motion. If nothing else, it is a change in thought that involves a movement from the 'before' to the 'after'. For what preceded it, the awareness of sound now becomes an awareness of something different, the awareness of the absence of sound. That change in thought is accompanied by a change in time. For where we find change, we find time, and this time, like the duration of the soul, is successive.

In the Compendium Musicae Descartes introduces the concept of 'rest' as a positive factor in the perception of a musical composition. Variety in all things is most pleasing, and it is necessary for the enjoyment of the composition.⁸³ "Rest" is "nothing in itself". Yet it introduces novelty and variety and lends pleasure to the ear in the perception of the composition as an entire work.⁸⁴ The awareness of 'rest' has its own time and that awareness when contrasted with an awareness of sound, which has its own time, provides a variant that enhances the perception of the composition. Descartes recognizes time, in itself, to

be an intrinsic positive feature in music. In music, time has such power that it alone can be pleasurable by itself since the ear has nothing to attract its attention but the time.⁸⁵ Hence, the intrinsic variety that 'rest' lends to the composition is the temporal variation by which the time of rest can be contrasted with the time of sound. The two modes of rest (silence) and movement (sound) which constitute the composition are intermingled throughout the entire composition. Since rest is nothing in itself, that is, not a movement, the awareness of the time of rest is, for Descartes, as it is for Augustine, a perception of the soul's own duration that is spread over the time of rest.

It is apparent that the subjective aspect of time is critical to Augustine's theory of time. However, we have seen that time has ontological status as a created reality (cf. ftn. #44). It is legitimate to ask the question how Augustine's subjective view of time as existing in present consciousness is consistent with his recognition of an objective temporal order. As we have seen in Book XI of the Confessions, Augustine assumes a subjective perspective of time, noting that "I measure tracts of time in the soul." In Book XII, he makes a shift and assumes an objective position. While it remains true that the soul measures tracts of time as it relates to consciousness, nevertheless, there are corresponding tracts of time in the objective order:

Out of this unordered and invisible earth, out of this formlessness, out of this almost-nothing you made all things, of which this mutable world stands firm, and yet does not stand firm, in which mutability itself is apparent, in which tracts of time can be perceived and numbered off. For tracts of time result from the changes of things, according as the forms, for which the aforesaid invisible earth is the matter, are varied and turned about.⁸⁶

Time cannot be without created being, and all things, including the soul, are in time insofar as they manifest some change. The soul exists simultaneously with time and with all other creatures in time. In order to measure time, the soul compares the time required by one motion with the time required by another motion, calling one 'longer' and the other 'shorter'.⁸⁷

Here, time is an activity of the soul, since what is being measured is primarily the soul's own perception of the external motion. The perceptions, however, consist in the representations and images of the successive motion. The soul, as disentio animi, is extended through its sense memories, present sensations and future projections. In this way the soul makes contact with the objective order. We may quote Augustine to support this view, for he writes: "Through its attention, it directs the senses outwardly towards a body and unites with it in order to see it and to fix its gaze upon it".⁸⁸ The soul as an indivisible unity is directly aware of the body's sensations that are "directed to changeable and corporeal things" and the soul "takes in the likenesses of realities through the senses."⁸⁹

Since the operations of the soul, including sensation and cognition, can be performed simultaneously, the soul can perceive the objective order and intellectually measure the movement of corporeal creatures.⁹⁰ The soul, like things, is extended in time and therefore can be cognitively aware of the movement of things that simultaneously exist with the soul. While what is being measured are tracts of time in the soul, these are the spiritual counterparts of the sensible phenomena in the objective temporal order. Thus, the soul as distentio animi cooperates with its extended senses and by that means the soul realizes a unity with an objective order in which the soul perceives and can measure the movement of corporeal creatures.

Although it is the motion in the soul that gives rise to the consciousness of time, nevertheless, that motion coincides with the successive motion in the objective order. One need only read Book VI of the De Musica to see that this is the case. For in the recitation of the syllable we find that there is "in the soul that motion made when the beginning sounded".⁹¹ While the soul is independent of the laws to which external motions are subject, nevertheless, the soul is in time, and is subject to changes (spiritual motions), and these occur in succession just as do the changes in the physical order.

The consciousness of the movement of the body is itself a spiritual motion with its own duration. That

duration can be measured and its measurement can be applied to the physical movement of the body. The soul is aware of when a body starts to move and of when it stops moving. The length of the duration of the soul's awareness is the measure which the soul applies to the physical movement itself.

When a body is moved, I measure in time how long it is moved, from when it begins to be moved until it ceases. If I did not see when it began and if it continues to be moved, so that I cannot see when it stops, I am unable to measure it, except perhaps from the time I begin to see it until I stop. If I look at it for long, I can merely report that it is a long time, but not how long.⁹²

The soul's awareness of the duration of things arises from the soul's awareness of its own duration. While time may be a distention of the soul, and while time is, per se, not the movement of a body, nevertheless it remains true that the soul shares a common duration with corporeal creatures. The soul becomes the vehicle by which the temporal movement of things outside the soul is perceived and measured. Thus, the soul, as distentio animi, makes it possible to reconcile Augustine's subjective aspect of time with an objective temporal order.

Spiritual creatures are superior to corporeal creatures and spiritual motions superior to physical motion. Yet all motion is distended from the past through the present and into the future. Where there is change there is successive duration and where there is successive duration there is time. If there is time and it is measured, there

must be a soul that does the measuring. From the psychological perspective, Augustine sees time as an activity of the soul.

Descartes endorses this Augustinian view of time. Like Augustine, he recognizes that time is a fundamental property of all created substances insofar as they have a successive duration in which there is perpetual change. While Descartes adopts Aristotle's definition of time as a number and measure, he chooses to stress the psychological aspect that is implicit in that description of time.

If time is a number and measure, there must be a numberer and measurer and Descartes is not hesitant in emphasizing the subjective aspect of time, calling it a 'mode of thought'. The soul clearly plays a pivotal role in the context of that definition. From the features that spiritual substances share with corporeal substances such as existence, unity, number and duration,⁹³ derive the clear and distinct ideas about corporeal substance which the soul first possesses about itself. These ideas can be transferred to any object outside the soul; duration is one of these ideas.⁹⁴

In the order of discovery the soul through changes in itself (e.g., in thought), becomes aware of its own successive duration prior to any awareness of the successive duration of things outside itself. That discovery initiates the recognition that the things outside the soul, with which

the soul coexists, share a common duration with the soul:

Je ne connois pas autrement la duree successive des choses qui sont mues, ou meme celle de leur mouvement que je fais la duree des choses non mues; car le devant et l'apres de toutes les durees quelles qu'elles soient, me parait par le devant et par l'apres de la duree successive que je decouvre en ma pensee avec laquelle les autres choses sont coexistantes.⁹⁵

The soul, intimately joined with its body, perceives an objective order with which the soul coexists. The common duration of both spiritual and material substances brings the soul into a relationship with the physical order and gives the soul access to the movements of material substances. That mutual coexistence means that the soul can intellectually accompany the movement of things and that it "puis assigner a chacun de ces mouvemens toutes sortes de durees."⁹⁶

Descartes concurs with Augustine that time is not, per se, the movement of a body. Even if there were no bodies in the world, the duration of the thinking substance would still be successive (cf. ftn. #48). And if no bodies existed, there would still be time. Insofar as the thinking substance is aware of the changes in its own consciousness, it is aware of its own duration and that duration could be measured. And if no physical movements existed outside, the soul could still measure its inner duration by contrasting the duration of one state of consciousness with another, noting the one to be 'longer' or 'shorter' than another. It is accurate to say, then, that the soul

measures tracts of time in the soul. For Descartes, time is the number of movement and a measure of duration. That numbering and measuring must be referred to the soul. In this sense, time is clearly a 'mode of thought'.

1. Summary of Augustine vs. Descartes

The psychological aspect of time provided by St. Augustine prevails as one of his most innovative theories and the convergence of thought between Descartes' theory of time and Augustine's theory gives weight to the thesis that Augustine had an influence on Descartes' theory of time. No doubt there are dissimilarities between Augustine and Descartes regarding time. But these are not substantive differences, they are, rather, perspectival differences.

The context in which Augustine gives expression to time is one quite removed from that of Descartes. Augustine's theory of time finds its meaning within the context of his spiritual life. The soul, in time, finds itself subject to the dispersion of temporal existence even as it discovers the eternal in the contrast with time. Life is a distention, that is, a distraction that keeps the soul from rising to a higher life of grace and ultimately to a contemplation of God.

But since "your mercy is better than lives," I behold, my life is a distention, or distraction. But "your right hand has upheld me" in my Lord, the Son of man, mediator between you, the One, and us, the many, who

are dissipated in many ways upon many things; so that by him "I may apprehend, in whom I have been apprehended," and may be gathered together again from my former days, to follow the One; "forgetting the things that are behind" and not distended but extended, not to things that shall be and shall pass away, but "to those things which are before"; not purposelessly but purposively, "I follow on for the prize of supernal vocation," where "I may hear the voice of your praise," and "contemplate your delights," which neither come nor go.⁹⁷

While Augustine approaches time as a wayfarer on a journey taking him to God, Descartes approaches time as a "savant" on a journey leading him to a contemplation of the truths of nature. For Augustine the soul as distentio animi suffers from the distractions that keep the soul from achieving a greater unity with God. For Descartes the soul can only be quasi-attentive for any one moment. Hence, the soul immersed in a world of change can be distracted and turn its attention away from the very evidence that the soul must assent to in order to see the truth. The method for attaining truth in the sciences is fundamentally Descartes' attempt to show how the soul can surmount the dispersion of thought and fix its attention on the cumulative elements that constitute the ultimate intuition in which the whole is seen "a la fois".

For both Augustine and Descartes the soul moves in time. For Augustine that movement has spiritual consequences. It is a movement to the "Light which brings light",⁹⁸ a movement from the temporal to the eternal. For Descartes, the soul's movement in time has epistemic

consequences. It is a movement to see the light whose source is God as the creator of all truth.⁹⁹ It is a movement to see the incontestable, unchangeable truth that is present to an attentive mind. Ultimately, for both Augustine and Descartes, the movement of the soul in time is a drive towards eternity. This drive partially overcomes the soul's temporality which is marked by perpetual change and by the distractions caused by change.

The extent of Augustine's influence on Descartes' theory of time is open to debate. Perhaps H. Marrou's assessment is not far off when he makes the dramatic statement that "it is often through the Cartesian prism that they [men] learn to discover Augustinian thought" (cf. fn. #5). If this last statement is not true, nevertheless, as the comparative analysis indicates, we can derive a clearer understanding of Descartes' theory of time if we are familiar with St. Augustine's theory.

NOTES - CHAPTER V

¹Camille de Rochemonteix, S.J., Un College de Jesuites Aux XVII et XVIII Siecles: Le College Henri IV de la Fleche. 4 Vols. (Le Mans, 1889), vol. 4, pp. 1-77, for a description of the theological and philosophical program taught at La Fleche. Pp. 21-32 give a specific description of the Aristotelian curriculum included in the program.

²Descartes rejected Aristotle's metaphysics because the latter proposed that all reality was constituted by immaterial substantial forms. Such forms failed to meet the exigencies of a mathematical science whose principles and laws were to be applied to the phenomena in nature. In Descartes' eyes these immaterial, occult forms could not yield any certitude that was incontestable; cf. A Morin, 13, July 1638, A.M. III, p. 310; A Mersenne, 23 Apr. 1643, A.T. III, p. 649; A Regius, Jan, 1642, A.T. III, p. 491; Prin. IV, 198, A.T. IX, p. 317; A Mersenne, 28, Oct., 1640, A.M. IV, p. 183.

³A Mesland, 3, May, 1644, A.T. IV, p. 119; A Colvius, 14, Nov., 1640, A.T. III, p. 247. A. Koyre, E. Gilson, and F. Copelston all note that Descartes had some acquaintance with Augustine through his relations with the Oratory of Cardinal de Berulle. Cf. Alexander Koyre, L'idee de Dieu dans la philosophie de Saint Anselme (Paris 1923), pp. XIIIff.; E. Gilson, Etudes sur le Role de la pensee medievale dans la formation du systeme cartesien, p. 199; Frederick Copleston, A History of Philosophy (New York 1963), vol. 4, p. 112.

⁴A. G. Balz, Descartes and the Modern Mind (New Haven, 1952), p. 26; La Forge, Traite de l'esprit de l'homme, pp. 3-32 (cited by E. Gilson, Etudes, p. 292; Henri Marrou, St. Augustine and His Influence Through the Ages (New York 1957), pp. 171ff; Herman Reith, Rene Descartes. The Story of a Soul (Notre Dame 1986), pp. 8-10; J. Sirven, Les annees d'apprentissage de Descartes (Paris, 1928), p. 18; A. Koyre, pp. 199ff.; E. Gilson, pp. 199, 261.

⁵H. Marrou, p. 171.

⁶A Vatier, 15, May, 1644, Cousins, vol. 9. "I will be happy to return to La Fleche, where I remained for 8 or 9

years of my youth, and it is there that I received the first seeds of everything I ever learned, which I owe to your Company of Jesuits."

⁷Discours, A.T. VI, p. 77. H.R. I, p. 129. "And I do not even boast of being the first discoverer of any of them [opinions], but only state that I have adopted them, not because they have been held by others but only because Reason has persuaded me of their truth."

⁸Aristotle, Physics, IV, 11, 220a25, p. 293.

⁹J. Vigier, p. 227. "Does not Aristotle define time as the number of local movement? But Descartes breaks with tradition by substituting for that concept what he believes time to be, 'a mode of thought'."

¹⁰Prin. I, 57, A.T. IX, pp. 49-50, H.R. I, p. 242. "The time, for example, that we distinguish from duration taken in general and that we say to be the number of movement, is only a certain way of conceiving that duration provided that we do not conceive of the duration of things which are moved as being different from that of things which are not."

¹¹Aristotle, Physics, IV, 12, 221a33-221b3, p. 295.

¹²Ibid., 11, 219b10, p. 292.

¹³Ibid., 218b21-4; 218b29-33, pp. 290-1.

¹⁴For Aristotle, the soul is the principle of life, it is the first grade of actuality of a natural body having life potentially. Under the category of 'living' Aristotle includes both rational and irrational functions, i.e., thinking or perception, local movement, sensation, appetition, nutrition, decay and growth. Cf. On the Soul, II, 412b1-3, p. 555; 413b1-5, p. 557; the passive intellect (that which changes) is a part of the soul and is destructible since it is dependent on the body for the sense perceptions from which the form of the object is received. The mind, or active intellect, is not a part of the soul for Aristotle, and it alone is immortal and eternal. Cf. III, 430a10-25, pp. 591-592. While the passive intellect is subject to time, the active intellect, Aristotle seems to suggest, is not in time. However, Aristotle provides no further treatment on the nature of the active intellect and

we are left uncertain of the temporal status of the active intellect while it exists in man.

¹⁵A Arnould, 29, July, 1648, Pleiade, p. 1309. "I conceive the successive duration of things that move and of motion itself no differently from that of things that do not move; for before and after in any duration are known to me by the before and after of the successive duration that I detect in my thought, with which other things co-exist."

¹⁶Aristotle, Physics, IV, 12, 220b24-26, p. 294.

¹⁷*Ibid.*, 11, 219b10-25, p. 292; 220a1, p. 293; the distinctions of 'before and after' are used primarily as spatial distinctions (place) and the 'before' and 'after' are found in time because time corresponds to the motion and the motion to the magnitude; cf. *ibid.*, 219a14-19, p. 291.

¹⁸*Ibid.*, 219b5-9, p. 292. Number, for Aristotle, does not exist apart from what is numbered.

¹⁹*Ibid.*, 220a17, p. 293; 13, 222b9, p. 297.

²⁰*Ibid.*, 220a5, p. 293; 13, 222a10-15, p. 296; cf. VIII, I, 251b19-21, p. 357.

²¹*Ibid.*, 11, 219a21-25, pp. 291-292.

²²*Ibid.*, 14, 223a25-28, p. 299.

²³*Ibid.*, 11, 219a10-13, p. 291.

²⁴*Ibid.*, 12, 221a1, p. 294.

²⁵*Ibid.*, 221b15-30, p. 296.

²⁶*Ibid.*, 221b26-33, p. 296; cf. 13, 222b16-20, p. 298.

²⁷I Med. A.T. IX, p. 15. H.R. I, p. 146. "There are at least some other objects yet more simple and more universal, which are real and true...To such a class of things pertains corporeal nature in general, and its extension,

the figure of extended things, their quantity or magnitude and numbers, as also the place in which they are, the time which measures their duration, and so."

²⁸Prin. I, 55 A.T. IX, p. 49.

²⁹Aristotle, Physics, IV, 12, 220b15-20, p. 294.

³⁰Ibid., 14, 223b15-24, p. 299.

³¹Prin. I, 57, A.T. IX, p. 50. H.R.I, p. 242. "But in order to comprehend the duration of all things under the same measure, we usually compare their duration with the duration of the greatest and most regular motions, which are those that create years and days, and these we term time. Hence this adds nothing to the notion of duration, generally taken, but a mode of thinking."

³²Discours, A.T. VI, p. 59.

³³Regle XIV, Pleiade, p. 102. H.R. I, p. 61. "By dimension I understand nothing but the mode and aspect according to which a subject is considered to be measurable. Thus it is not merely the case that length, breadth and depth are dimensions...speed is a dimension of motion, and there are an infinite number of similar instances...It clearly follows that there may be an infinite number of dimensions in the same subject, which make no addition at all to the objects which possess them, but have the same meaning whether they are based on anything real in the objects themselves, or are the arbitrary inventions of our minds. It is indeed something real...the division of a century into years and days. But it is otherwise with the division of the day into hours and moments, etc. Yet all of these subdivisions are exactly similar if considered merely from the point of view of dimension." Everything, for Descartes, that is measurable is analogous to extension, and therefore continuous. Cf. pp. 104-105.

³⁴Regle XIV, Pleiade, p. 97.

³⁵Aristotle, Metaphysics, X, 1, 1052b20-24, p. 836.

³⁶Ent. avec Burman, Pleiade, p. 1358.

³⁷Regle XVI, Pleiade, p. 110. "...double function of numbers, the same numbers explain now order, and then measure."

³⁸Aristotle, Physics, IV, 14, 223a7-10, p. 298.

³⁹Ibid., 13, 222b10, p. 297.

⁴⁰Ibid., VI, 6, 231a24, p. 316.

⁴¹Metaphysics, X, 1, 1052b15-17, p. 836.

⁴²Physics, IV, 14, 223a0-14, p. 298.

⁴³John Callahan, Four Views of Time in Ancient Philosophy (Cambridge 1948), p. 76.

⁴⁴The Confessions of St. Augustine, trans. by John K. Ryan (New York 1960), 11,13, p. 286, 11,30, p. 303.

⁴⁵Ibid., 10, p. 285; 11, p. 285; 13, p. 286; 14, p. 287; 30, p. 303. Cf. St. Augustine, The City of God, XII, XV, p. 195; XI, VI, p. 148; Basic Writings of St. Augustine, ed., Whitney J. Oates, vol. 2 (New York 1948).

⁴⁶St. Augustine, The Literal Meaning of Genesis, trans. by John Hammond, VIII, 20, p. 60. Ancient Christian Writers, vol. II (New York 1982).

⁴⁷A Arnould, 4, June, 1648, Pleiade, p. 1304. Kenny, p. 232. "Even if no bodies existed it could still not be said that the duration of the human mind was entirely simultaneous like the duration of God; because our thoughts display a successiveness which cannot be attributed to the divine thoughts."

⁴⁸The Literal Meaning of Genesis, V, 5, p. 154.

⁴⁹Confessions, 11,14, p. 287.

⁵⁰Ibid., 15, p. 289.

⁵¹Etienne Gilson, The Christian Philosophy of St. Augustine (New York 1960), p. 193; cf. Note p. 338.

⁵²The City of God, XII, 25, p. 207; cf. XXII, 24, p. 524; XXII-XXIV, pp. 647-648; The Literal Meaning of Genesis, IV, 12, p. 117.

⁵³Prin. I, 21, A.T. IX, p. 34; III Med. A.T. IX, p. 39; I Resp. A.T. IX, p. 88.

⁵⁴V Resp. Pleiade, p. 493. "...cease to be in each moment of its duration."

⁵⁵A Hyperaspistes, Aug., 1641, Pleiade, p. 1134. Kenny, p. 116. "There is no doubt that if God withdrew his co-operation everything which he has created would go to nothing; because all things were nothing until God created them and provided his co-operation."

⁵⁶Confessions, 11,16, p. 290; 11,17, p. 290.

⁵⁷Ibid. 18, p. 291; cf. A Hyperaspistes, Aug., 1641, Pleiade, p. 1133. "Nothing can be acted on except by something present."

⁵⁸Ibid., 20, pp. 292-293. In the Latin version, the passage where Ryan translates "the present of things present is in intuition" reads as follows: "Praesens de praesentibus contuitus". This seems to imply a kind of intuition in which things that are seen are held together such that one has an integrative insight which would parallel Descartes' concept of "intuition" as it functions in enumeration. Regle XI, Pleiade, pp. 72-73. A Latin version of the Confessions is contained in Sancti Augustini, Confessionum, vol. XXVII, p. 207. Corpus Christianorum, ed. Lucas Verheijen (Brepols, 1981).

⁵⁹Confessions, 11,23, p. 296. A rejection of Aristotle's belief that time is measured by physical motion, and most significantly by the regular motions of the astronomical system.

⁶⁰Ibid., 26, p. 298; cf. Ryan's ftn. p. 411 where he makes the comment that distention is an activity of the mind "so as to hold things as present". The distention of the mind is referred to in the Latin as "distentio animi".

⁶¹Ibid., 27, p. 300.

⁶²Ibid., 27, p. 300.

⁶³Ibid.

⁶⁴Ibid., p. 301. In the Pine-Coffin translation, "present intention" is translated as "attentive mind which is present". Cf. St. Augustine, Confessions, trans. by R.S. Pine-Coffin (London 1961), p. 277. The original Latin version reads as follows: "praesens intentio". Cf. L. Verheijen, p. 213. Augustine uses both terms in conjunction with the will. Cf. St. Augustine, The Trinity, trans. by Stephen McKenna, The Fathers of the Church (Washington 1963), vol. 45, "The intention of the will..." IV, p. 326; cf. XV, p. 457, "...the attention of the will". In the French translation A. Solignac makes the comment that Augustine sometimes uses the term "attention" and sometime "intentio". The first term he notes is objective, it expresses the permanence of the mind in deploying its attention on the object. The term "intentio" is more subjective, it expresses the act of the mind which unifies the totality of the moments. Regarding the distention of the mind in terms of its intentionality, Solignac refers to it as "une intention distendue et une distention intentionnalisee". Cf. St. Augustine, Les Confessions, Introduction & Notes by A. Solignac. Traduction de E. Trehaiel & G. Bouissou (Paris, 1962), vol. 14, pp. 590-591. In this study, we have used both "intentionality" and "attention" interchangeably since Augustine uses both of them in conjunction with the will and the will is a part of the indivisible soul.

⁶⁵Confessions, 28, p. 301. This is reminiscent of William James' position that consciousness is a "stream" of thought in which one state melts into another like an unbroken stream. There are no time gaps between past, present, and future, an implicit, if not explicit, argument for the continuity of time and duration. Cf. William James, Principles of Psychology, The Writings of William James. Edited by John McDermott (New York 1968), pp. 31-40.

⁶⁶Confessions, 28, p. 301.

⁶⁷Trinity, XI, 5, pp. 7-8; XII, 15, p. 366.

⁶⁸Regle X, Pleiade, p. 72. "...we must seek out rather for all the aids by which our thought may be kept attentive." Descartes often refers to "attention" as taking place in the 'present'. Cf. II Med. A.T. IX, p. 24; Regle XII, Pleiade, p. 84; Passions 76, A.T. XI, p. e8e.

⁶⁹Regle XI, Pleiade, p. 75; H.R. I, p. 34. "...these two operations aid and complete each other. In doing so

they seem to grow into a single process by virtue of a sort of motion of thought which has an attentive and vision-like knowledge of one fact and yet can pass at the very same moment to another."

⁷⁰Regle XI, Pleiade, p. 72. H.R. I, p. 33. "If, after we have recognized intuitively a number of simple truths, we wish to draw any inference from them, it is useful to run them over in a continuous and uninterrupted act of thought, to reflect upon their relations to one another, and to grasp together distinctly a number of these propositions so far as is possible at the same time. For this is a way of making our knowledge much more certain and of greatly increasing the power of the mind."

⁷¹Regle VII, Pleiade, p. 59.

⁷²Regle III, Pleiade, pp. 44-45. H.R. I, p. 8. "Many things are known with certainty, though not by themselves evident, but only deduced from true and known principles by the continuous and uninterrupted action of a mind that has a clear vision of each step in the process. It is in a similar way that we know that the last link in a long chain is connected with the first, even though we do not take in by means of one and the same act of vision all the intermediate links on which that connection depends, but only remember that we have taken them successively under review and that each single one is united to its neighbor, from the first even to the last...[deduction] its certitude is rather conferred upon it in some way by memory."

⁷³St. Augustine, On Music, trans. by Robert Catesby Taliaferro, The Fathers of the Church (New York 1947), IV, 3, p. 175.

⁷⁴Ibid., VI, 14, p. 370.

⁷⁵De La Musique, Cousins, vol. V, p. 445.

⁷⁶Ibid., pp. 470-486.

⁷⁷On Music, VI, 8, p. 345.

⁷⁸Ibid., p. 356.

⁷⁹De La Musique, Cousins, p. 450. Robert, p. 14.

"This proportion is often stressed so strongly among the components of a composition that it aids our understanding to such an extent that while hearing the end of one time unit, we still remember what occurred at the beginning and during the remainder of the composition. This happens when the entire melody consists of 8 or 16 or 32 or 64 units, etc., i.e., all divisions result from 1:2 proportion. For then we hear the first two units as one, then we add a third unit to the first two, so that the proportion is 1:3; on hearing unit 4, we connect it with the third, so that we apprehend them together; then we connect the first two with the last two, so that we grasp those four as a unit; and so our imagination proceeds to the end, when the whole melody is finally understood as the sum of many equal parts."

⁸⁰On Music, VI, 10, pp. 353-354.

⁸¹Ibid., VI, ftn. #7, p. 353.

⁸²Confessions, XI, 24, p. 297.

⁸³De La Musique, p. 475.

⁸⁴Ibid., p. 475.

⁸⁵Ibid., p. 450.

⁸⁶Confessions, XII, 8, pp. 309-310. Cf. XII, 11, p. 312; 29, p. 331; 37, p. 369; Genesis IV, 35, p. 145; IV, 20, p. 127.

⁸⁷Confessions, XI, 27, pp. 299-300.

⁸⁸Trinity, XI, 2, p. 319; cf. p. 321; 4, p. 326; XIV, 8, p. 426; XV, 3, p. 457; St. Augustine, The Magnitude of the Soul, trans. by John J. McMahon, The Fathers of the Church (New York 1947), vol. IV, 30, pp. 125-127.

⁸⁹Trinity, XII, 13, p. 362. Magnitude of the Soul, 33, p. 138.

⁹⁰Magnitude of the Soul, 35, p. 146.

⁹¹On Music, VI, 8, p. 345.

⁹²Confessions, XI, 24, p. 296.

⁹³Regle XII, Pleiade, pp. 81-82; III Med. A.T. IX, p. 35.

⁹⁴III Med. A.T. IX, p. 35.

⁹⁵A Arnauld, 29, July, 1648, Pleiade, p. 1309. "I conceive the successive duration of things that move and of motion itself no differently from that of things that do not move; for before and after in any duration are known to me by the before and after of the successive duration that I detect in my thought, with which other things co-exist." Although there is a radical distinction between the soul and body, Descartes attests that perception is a function of the soul and that the soul is intimately united with its body. The soul receives images and impressions of corporeal substances and these impressions are somehow transmitted to the soul via the pineal gland. Cf. VI Med., A.T. IX, pp. 58ff., which describes Descartes' effort to explain the union between body and soul. It is beyond the scope of this study to discuss the difficulties endemic to Descartes' mind/body relationship. What is certain is that Descartes believed that the soul does have access to the physical order through the medium of its extended sense organs, and in this he is not far off from Augustine in his concept that the soul is directly aware of its sense perceptions. Augustine, however, unlike Descartes, recognizes the soul as the principle of life of the body. Cf. Magnitude of the Soul, 5, p. 66.

⁹⁶V. Med. A.T. IX, p. 50. "...[I] can assign to each of these movements all kinds of durations."

⁹⁷Confessions, XI, 29, p. 302; cf. Trinity, XII, 4 p. 345; 8, pp. 355-356; 7, p. 352; 14, p. 365.

⁹⁸Confessions, XII, 15, p. 316.

⁹⁹Prin. I, 30, A.T. IX, p. 30; III Med. A.T. IX, p. 32; A Mersenne, 16 October 1639, A.T. III, p. 598; Resp. A.T. IX, p. 184; Prin. I, 29, A.T. IX, p. 37; A Marquis de Newcastle, Mar ou Apr., 1648, A.T. V, p. 136; A Unknown, March 1637, A.T. I, p. 353

CHAPTER VI

CONCLUSION: A COHERENT THEORY OF TIME

This study has accomplished its four intended goals. First of all, it has examined time as an integral part of an entire philosophical system, a close network of inter-related themes and concepts. For an understanding of time this study has focused on Descartes' primary aim, namely, to establish a universal science, essentially a mathematical kind of physics. That goal prompted him to formulate a metaphysical foundation which polarized the finite order into two radically heterogeneous kinds of substances. Although both material substances and thinking substances share a common duration, their fundamental disparity affects the manner in which their temporality is manifested in the Cartesian system. For that reason, we presented a dual perspective approach to time. This explicated the dynamic ways in which the temporality of the two kinds of substances functioned within Descartes' overall scientific concerns.

Secondly, this study discredited the classical thesis that time, for Descartes, is discontinuous and that Descartes endorsed the theory that time was constituted by absolutely indivisible instants of no temporal duration. An in-depth look at the relevant texts testifies that such beliefs are

not grounded on fact.

Thirdly, time is the number of movement and a measure of duration. For this reason we considered time from a mathematical perspective in accordance with Descartes' view that number expresses both order and measure. Because the duration of all substances is successive, yet continuous, it can be perceived as both discrete quantity and continuous quantity, as such duration is both numerable and measurable.

And time is the number. We have also, when applicable, utilized graphic mathematical examples to illustrate certain points. This was appropriate in light of Descartes' belief that the discovery of truth and resolution of problems could be achieved by using the mathematical method. As evidenced by the Regles graphic illustrations were part of that method.

Fourthly, the comparative analysis of Descartes' theory of time with those of both Aristotle and Augustine has demonstrated how Descartes utilized traditional historical thought for his own purposes. Unlike Aristotle and Augustine, Descartes never treated time as a special issue in any concentrated and systematic fashion. Yet this does not mean he failed to have a theory of time. What Descartes did was to make use of certain elements found in both Aristotle and Augustine. Descartes utilized Aristotle's description of time as a number of movement and a measure of duration. He coupled that with Augustine's psychological perspective on

time. Descartes, countenancing Augustine's emphasis on the role of the soul, called time a 'mode of thought'.

Descartes' lack of a totally original theory of time suggests that Descartes was not so much concerned to offer an elaborate and unique theory of time as he was to have a theory that could be reconciled with other constitutive elements of his philosophy. What we may presume is that Descartes was content to take what he needed from others who had already given their concentrated efforts and consideration to the subject. Having done this, Descartes was free to focus his own mental energies on the greater task of constructing a metaphysical foundation for his science. As the volume of Descartes' works and his own admission indicate, his ultimate concerns were scientific. Time as a number and measure, and time as also a mode of thought, fit well within the framework of those concerns.

Does Descartes have a coherent theory of time? Divergent interpretations of his theory found in the commentaries suggest that he did not provide a doctrine that was clear and unambiguous. There are two reasons that may occasion this assessment. The first reason is that, unlike Aristotle and Augustine, Descartes never treated time as a special topic. Hence, what Descartes has to say about time is dispersed throughout his works and is most often treated incidentally as a subordinate issue within the immediate context in which it appears, and, more importantly, within

the broader context of Descartes' ultimate scientific concerns.

There is a second reason for the divergence of opinion: More fundamental problems endemic to Descartes' metaphysical dualism. Because of the incoherencies within that metaphysics it would seem to follow that Descartes cannot have a coherent theory of time. However, an assessment of Descartes' theory of time based solely on his metaphysics fails to result in an accurate interpretation and judgment of his theory. Descartes' metaphysics is simply one component of a complex philosophical system and it is in relationship to that system that his metaphysics derives its meaning.

Throughout this study it has been our thesis that any evaluation of Descartes' theory of time must take into account Descartes' philosophical system as an integrated whole. The sole purpose of Descartes' metaphysics was to provide a foundation for a mathematical kind of physics that would be characterized by its certitude and self-evident knowledge. To insure this, Descartes polarized the finite order into two disparate substances. Epistemic considerations prompted Descartes to attribute one essential attribute to the material world. That attribute was extension. As extended, the physical universe could be treated mathematically, since it would operate in accordance with the principles and laws of mathematics. Given the mathematical

structure of the world, it was theoretically possible to arrive at some moral certitude about the phenomena in nature. The thinking substance, in the world but not of the world, was so endowed that by virtue of its sole essential attribute, thought, the thinking substance could attain increasing knowledge about the manner in which the universe operated. This vision of nature required him to use a method that was employed in the mathematical sciences for the attainment of truth.

It is within the context of that overall project to construct a mathematical physics that we must evaluate Descartes' theory of time. Hence, the question should not be: Does Descartes have a coherent theory of time? Rather, the question should be: Does Descartes' theory of time accommodate the metaphysical dualism which constitutes the foundation for his mathematical physics? I believe it does.

A comprehensive analysis of Descartes' theory of time has been provided. That analysis considered time as a fundamental property of two heterogeneous kinds of substances. For that reason, we could not treat time as a univocal concept applicable to all substances. Although both kinds of substances share a common successive duration, the temporality of both kinds of substances is manifested in distinct ways. As our dual perspective approach has demonstrated, time is an analogical concept in the philosophy of Descartes. Examined as such, Descartes' theory of time appears to be

neither paradoxical nor incoherent. On the contrary, time constitutes a neatly woven strand within the tapestry of Descartes' total philosophy and serves to complete the intended design. Our summary will place this statement into perspective.

A. Summary of Descartes' Theory of Time

Time is real. It is a property of the existing substance insofar as that substance endures. But what else is time for Descartes? Accepting Aristotle's definition, Descartes describes "le temps" as "le nombre du mouvement".¹ He couples this with the psychological perspective of Augustine by also calling time "une certain facon dont nous pensons" about the duration of all things.² Fundamentally, that duration, shared by both material and thinking substances, is successive. Because duration is successive, there is a numerable aspect to it insofar as it is constituted by parts ordered one to another as 'before' and 'after'.

Since one of the functions of number is to express order, it is possible to number the parts of duration perceived as 'before' and 'after'. Insofar as they are discrete quantities they are countable. The ordinal aspect of duration means that time can number the successive 'before' and 'after' parts of duration as the first moment, second moment, third moment, etc. These parts can then be transposed into countable units so that the first, second, and third become

one moment, two moments, three moments, etc. Time can number duration because duration is a species of quantity. As successive, duration falls under the category of discrete quantity and is numerable.

However, if time is to truly function as a number, it must also serve to number continuous quantity. While the fundamental mode of duration is successive, nevertheless, Descartes recognizes another aspect of duration, its measurable aspect; for "la duree est un mode ou une facon dont nous considerons cette chose en tant qu'elle continue d'etre", and that duration "est etendue et divisible".³

Analogous to extension, duration is continuous in the same way that a magnitude is continuous. The magnitude is measured in the same way that we measure the length of a spear as an undivided whole. Because duration is continuous and hence measurable, time can be a number for measuring duration. With due consistency, we find Descartes referring to this function of time, "le temps qui mesure leur duree."⁴ Thus, when we conceive of the duration as a continuous whole, it is measured as a unit of length, and time is the number that expresses that measure. We are here conceiving duration as an unbroken whole whose parts exist simultaneously. Thus, continuity of existence is measured by time, such as ten minutes.

We see, then, how time functions as a number to express both the ordinal and measurable aspects of duration. But

time remains a mode of thought. For what is numberable and measurable can only be numbered and measured if there is a soul to number. Nevertheless, the soul qua numberer and measurer is not absolute in the sense that it needs no objective standard of measure. Adhering to the Aristotelian theory that time itself is measured by some movement, Descartes acknowledges the movements of the astronomical system to be the most general and ordinary standards of measure. The clock, as an artifice of man, can serve to measure smaller intervals of time. It is the soul, however, that determines which unit of measure to apply.

All movement has some measurable duration, and the rate of speed of the movement of the body, that is, the movement between two points, can be measured by using a reciprocal measure of motion, namely time. The standard of measure is a selective process, since the duration of a movement of a body can conceivably be measured in terms of one hour or sixty minutes with equal validity. Suppose that the soul wishes to focus its attention on a very brief phase of the movement, a phase less than a minute. What is to be used as a standard of measure? Would it be possible to say the motion was as short as the twinkling of an eye, or a flash of lightning, or instantaneous? The point is that it is the soul that applies to the movement a measure which conforms to the purpose of the soul in measuring the duration.

Time is a mode of thought, a way in which we think about the duration of things. It is that definition of time which resolves the paradox of how the instant can be indivisible and still constitute a part of continuous duration. To explain the point we need only recall that one of the primary characteristics of mathematics is its concern with order. Thus, to conceive of movement in terms of instantaneous phases is to view movement from a mathematical perspective. It is analogous to dividing a line by the imposition of points. A line without points is an actual measurable continuum without any actual parts.

On the other hand, a line on which points are imposed is, by virtue of these points, no longer an extended magnitude whose parts exist simultaneously. With the imposition of points the line is divided into parts ordered one to another as prior and posterior. The prior and posterior parts are numerable, and their number is determined by the position of each of the parts in relation to the other parts. Thus, the segment posterior to the first is numbered second, and the segment posterior to the second is third, and what follows that is fourth, etc. The significance of this is that the number of the segment in a successive series is determined by its relation to the other segments to which it is ordered.

If we transpose this geometric operation to Descartes' concept of movement, we find somewhat of an analogy. Movement,

like an extended magnitude, is actually continuous. As a continuum the movement has no separate phases. However, it is possible to mentally divide the movement, to freeze a segment for inspection and to consider its relation to the other phases. When this is done, the movement is not considered as a measurable whole whose parts exist simultaneously. Rather, the movement is conceived as being constituted by phases ordered one to another as 'before' and 'after'. In terms of Descartes' physics, this means that we can talk about the movement of a body in one instant and its relationship to the movement of a body in the next instant.

No doubt the ordinal aspect of duration prevails in the Cartesian physics. Moreover, that ordinal aspect is expressed in terms of the temporal 'instant' which measures the elementary phases of motion. When the soul considers the instantaneous phases of movement, the latter are considered as indivisible. Each phase is isolated in thought and is divided from the instant before and the instant after. They are not, however, indivisible in the sense that they are without duration. Movement takes place in an instant and all movement has some duration, "car il est impossible de concevoir...le mouvement prive de toute duree."⁵ As to the duration of "l'instant", Descartes always conceived it to have some measurable quantity. It is an "espace de temps", albeit a "peu de temps", "le plus court".⁶

The 'instant' with its mathematical implications is

well accommodated to Descartes' mathematical physics. It cannot, however, be adopted as the way in which we think about the duration of the thinking substance. The duration of the thinking substance is manifested in terms of cognitive events that take place in the 'present'. That part of time can be viewed in two ways. The 'present' is conceived as discrete quantity ordered to the other parts of time, or it is conceived as continuous quantity, the parts of which exist simultaneously. Descartes considers the 'present' in both ways.

In terms of his doctrine of method, Descartes stresses the self-evidency and immediacy of truth and conditions intuition on a 'present' in which the mind clearly and distinctly sees the truth of the evidence present to the understanding. This 'present', which is integral to the method of intuition, is ordered to the other parts of time. It is opposed to the past which is no longer, and the future which is not yet. Both of these parts of time have slipped out of present consciousness and are for that reason imbued with incertitude. In terms of intuition, the 'present' is a species of discrete quantity ordered to the other parts of time. Insofar as the 'present' is so conceived, the event of intuition reveals the manner in which the ordinal aspect of time functions as a feature of the duration of the thinking substance.

However, while the ordinal aspect of time comes into play, it does not predominate. As far as Descartes' doctrine

of method is concerned, deduction prevails as the method most utilized in the acquisition of truth. Deduction is really a series of intuitions; nevertheless, the intuitions are not discrete when they are part of the deductive process. While there is an order in the thought process such that the consequent necessarily follows from the immediate antecedent, the order is not projected as a series of discrete thoughts. The past and future are not separate units ordered to the present. On the contrary, the mind moves in a continuous and uninterrupted manner so that there is always a perpetual synthesis and convergence of past, present, and future. The 'present', which includes the past and future, has no determined duration. It must be long enough for the mind to hold both the antecedent and consequent in its present field of attention. The 'present' with its inclusive past and future endures for as long as attention abides.

As the deductive method clearly illustrates, there are no time gaps. Time is successive, but it is continuous.⁷ Like time, the duration of the thinking substance is continuous. That continuous duration means that the substance perdures as the same substance throughout all of the moments in which it exists. It is that continuous substantial permanence as a subject of cognitive actions which constitutes the noetic condition for the Cartesian physics inasmuch as the latter demands not only a knowable

object, but an agent of knowing. Descartes' doctrine of method prescribes the manner in which the thinking substance, endowed with an intrinsic faculty of knowing, can move in time towards an ever-increasing, though not exhaustive, knowledge about the universe.

Viewed from another dimension, the continuity of the duration of the thinking substance is the condition for the measurement of the duration of movement. A body moving between two points traverses an indefinite number of points; this movement can be measured only if it is perceived as a continuum corresponding to the magnitude which the body traverses. In order to measure the motion, the successive phases of the movement must be synthesized into a cohesive whole that is perceived as a continuum. In that case, the movement falls under the category of continuous quantity and is measurable. The measurement of the movement presupposes a corresponding measurable motion in the understanding mind which does the measuring. The interior continuous motion of the mind allows the latter to participate in the flux of external motion, and thus [I] "puis assigner a chacun de ces mouvemens toutes sortes de durees."⁸ As material substances move from place to place, so, too, does the thinking substance move along in thought. For both substances co-exist and share a common duration that is continuous.

Descartes' definition of time as the number of movement adapts itself not only to material substances insofar as they

undergo perpetual movement, it serves equally well to measure the duration of thinking substances. Descartes unequivocally maintains that, even if no bodies existed in the world, the duration of the thinking substance would be successive. Still, he draws attention to the continuous aspect of that duration, noting it "*sa dureee...est etendue et divisible*".⁹

The soul always thinks and thinking is a species of movement contained under the broader category of fundamentally successive change. Because it is successive, the 'before' and 'after' phases can be perceived as discrete quantity ordered one to another. Time can function as a number to express that order. Insofar as thought is continuous, it can be measured and time is that which measures it. Time as a number serves to express both order and measure. Just as with material substances, the thinking substance has both an ordinal and continuous aspect to its duration. These aspects can be adapted to the definition of time as a number of movement.

Duration is numerable because it can be perceived from its ordinal aspect (successive duration). Duration is measurable because it can be perceived from its continuous aspect. When we wish to think about those aspects we think about them in terms of time which expresses both order and measure. Time and duration (which time numbers and measures) fall under the category of mathematics. Thus, questions

regarding duration and time (as the number applicable to duration) are, in essence, questions about order and measure. Our procedure is, perhaps, an example of what Descartes had in mind when he proposed his universal mathematics:

Et si l'on y reflechit plus attentivement, on remarque enfin que seules toutes les choses où l'on etudie l'ordre et la mesure se rattachent a la mathematique, sans qu'il importe que cette mesure soit cherchee dans des nombres, des figures, des astres, des sons, ou quelque'autre objet; on remarque ainsi qu'il doit y avoir quelque science generale expliquant tout ce qu'on peut chercher touchant l'ordre et la mesure sans application a une matiere particuliere, et que cette science est appelee, non pas d'un nom etranger, mais d'un nom deja ancien et recu par l'usage mathematique universelle, parce qu'elle renferme tout ce pourquoi les autres sciences sont dites des parties de la mathematique.¹⁰

Descartes was not unmindful of the implications of his definition of time as a number. For if duration is numberable and time is the number, there must be a numberer. Descartes' insight prompted him to include as a part of his definition of time the psychological aspect of time. Time is a mode of thought. Although Descartes polarized the world into two distinct kinds of substances, there is always an implicit unity between the two. From an epistemic standpoint, material substances are related to the thinking substance as knowable objects. Correlatively, the thinking substance is related to material substances as the subject who can and does perceive the physical universe as a mathematical model which, Descartes believed, "agit en tout mathematique."¹¹ Because material substances and thinking substances share a common duration, the thinking substance

can apprehend the events in the physical order and, through reflection, come to have intellectual vision of the patterns according to which these events occur.

In spite of the radical heterogeneity between material substances and thinking substances, there is a metaphysical unity. Both substances exist, and to exist is to endure, and that duration is measured by time. As a consummate metaphysician with an extended and committed vision of a mathematical physics, Descartes formulated a coherent theory of time that served his purposes well.

NOTES - CHAPTER VI

¹Prin. I, 57, A.T. IX, pp. 49-50. "...the time...the number of movement..."

²Ibid., "...a certain way of thinking."

³Prin. I, 55, A.T. IX, p. 49. H.R. I, p. 241. "...the duration of each thing is a mode under which we shall consider this thing insofar as it continues to exist."

⁴I Med. A.T. IX, p. 15. "...the time which measures their duration."

⁵Regle XII, Pleiade, p. 83. "...for it is impossible to conceive...movement deprived of all duration."

⁶Prin. II, 33, A.T. IX, p. 82. "...space of time". Prin. III, 63, A.T. IX, p. 135. "...little bit of time". A Hyperaspistes, Aug. 1641, Pleiade, p. 1133. "...the briefest [instant]". Perhaps a duration equal to what we now know as a 'millisecond'?

⁷Since Descartes stresses the necessity of the uninterrupted movement of the mind in the process of deduction, it (deduction) provides a more apparent indication than does intuition that time is continuous. However, as we have argued in Chapter IV, even intuition implies the continuity of time since each of the intuitions is contingent on previous known truths that provide the evidence for the present intuitions. Intuition has a discursive aspect to it, but it is not stressed by Descartes because he wishes to focus on the self-evidence and immediacy of intuition. Hence, he conditions intuition on a 'present' that excludes the no longer existing past. Descartes does not, however, exclude the immediate past that is retained by and is part of present consciousness. Cf. Chapter IV, pp. 161-164.

⁸V Med. A.T. IX, p. 50. "...[I] can assign to each of these movements all sorts of durations."

⁹A Arnould, 4, June, 1648, A, M, VIII, p. 47. Ent. avec Burman, Pleiade, p. 1358. "...its duration...is extended and divisible."

¹⁰Regle IV, Pleiade, pp. 50-51. H.R. I, p. 13. "But as I considered the matter carefully, it gradually came to light that all those matters only were referred to Mathematics in which order and measurement are investigated, and that it makes no difference whether it be in numbers, figures, stars, sounds or any other object that the question of measurement arises. I saw consequently that there must be some general science to explain that element as a whole which gives rise to problems about order and measurement, restricted as these are to no special subject matter. This I perceived, was called 'Universal Mathematics', not a far-fetched designation, but one of long standing which has passed into current use, because in this science is contained everything on account of which the others are called parts of Mathematics."

¹¹A Mersenne, 11, March, 1640, A.T. III, p. 37. "... acts totally mathematically."

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The dissertation is therefore accepted in partial fulfillment of the requirements for the degree for Doctor of Philosophy.

November 27, 1990

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